

SEPTEMBER 6, 2023



491/20167.SDW - PHASE 500:

# CENTER FOR FORENSIC PSYCHIATRY - CREATE KITCHEN

SALINE, MICHIGAN

ARCHITECT'S PROJECT NO. 2021094

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This is a Cover Sheet to the State's Owner and Contractor Standard Construction Contract, known as the *MICHSPEC™* Division 0 Specifications. The *MICHSPEC™* Division 0 Specifications have been developed from the FORMSPEC™ Michigan Model, 1997 Edition. Although the State's 2008 Version of the Division 0 Specifications are written as simply as practical, it is nonetheless advisable to consult with companion Guide to Specifiers when preparing specifications for a specific project. These Division 0 Specifications were developed by incorporating provisions and requirements furnished by the State into the FORMSPEC™ Michigan Model. These Division 0 Specifications have undergone detailed technical reviews by Department of Technology, Management and Budget, **State Facilities Administration** representatives and detailed legal reviews by the Department of the Attorney General for the State of Michigan. Specifiers are encouraged to consult with a Division 0 specifications specialist or an attorney knowledgeable in public contracts when preparing specifications for a specific project.

**STATE OF MICHIGAN**

**DEPARTMENT OF TECHNOLOGY, MANAGEMENT AND BUDGET**

**STATE FACILITIES ADMINISTRATION**

**MICHSPEC™ 2008 VERSION, OWNER AND CONTRACTOR**

**STANDARD CONTRACT FORMS AND CONDITIONS OF THE CONTRACT**

**MICHSPEC™ No. 97.0820 – 00020 THROUGH 97.0820 – 00440**

**RELEASED ON NOVEMBER 1, 1997.**

Developed from  
Contract Forms and Conditions of the Contract  
FORMSPEC™ Michigan Model  
and suggested for use with  
Bidding Requirements

**File No. 491 /20167.SDW**  
**Funding Code 171 CODHHS7255**  
**Department/Agency MDHHS**  
**Center for Forensic Psychiatry-**  
**Kitchen**  
**8303 Platt Road**  
**Saline MI 48176**

**September 6, 2023**



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E0.02	ELECTRICAL STANDARD SCHEDULES
E0.03	ELECTRICAL DEMOLITION SITE PLAN
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E4.04	ELECTRICAL ROOF PLAN
E5.01	ONE LINE DIAGRAM - NEW WORK
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E6.02	ELECTRICAL ENLARGED PLAN
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**COMMUNICATIONS & IT DRAWINGS**

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TC1.02	CABLING CONNECTIVITY CODES
TC1.03	CABLING RACK LAYOUTS & DETAILS
TC1.04	FENCE DETECTION DETAILS
TC1.05	ACCESS CONTROL DETAILS
TC1.06	SECURITY ACCESS CONTROL DETAILS
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TC2.00	TECHNOLOGY SITE PLAN



<b>TC2.01</b>	<b>FIRST FLOOR TECHNOLOGY PLAN</b>
<b>TC2.01A</b>	<b>BASEMENT TECHNOLOGY PLAN AREA 100</b>

**SECTION 00020 GLOSSARY****1.1 Defined Terms:**

1.1.1. The following terms or relative pronouns used in Division 0 of the Specifications have these intent and meanings:

**Activity**– An element in the Progress Schedule establishing a requisite step, or the time and resources required, for completing the part of the Work associated with that Activity.

**Addenda**– Written instruments that are used by the **Owner** and/or **Professional** to incorporate interpretations or clarifications, modifications, and other information into the Bidding Documents. An Addendum issued after Bid opening to those Bidders who submitted a Bid, for the purpose of rebidding the Work without readvertising, is referred to as a post-Bid Addendum.

**Agreement**– The written agreement between the **Owner** and **Contractor** covering the Work to be furnished and performed.

**Alternate**– Refers to Work specified in the Bidding Documents for which the Bidder shall bid a Bid Price in the space provided in the Schedule of Alternates in Section 00300 Bid Form.

**Apparent Low Bidder**– Those Bidders whose Base Bid, when added to those specific Alternates the Owner intends to accept, yields the three lowest sums of Base Bid and Alternates. Additional Bidders may be considered Apparent Low Bidders if their Base Bid, when added to those specific Alternates the Owner intends to accept, yields a sum within 10% of the lowest of the Apparent Low Bidder's sum. If a qualified disabled veteran meets the requirements of the contract solicitation and with the veteran's preference is the lowest Bidder is considered the Apparent Low Bidder.

**Archaeological Feature**– Any prehistoric or historic deposit of archaeological value, as determined by a representative of a State agency that is duly authorized to evaluate such findings and render such judgments. An Archaeological Feature deposit may include, but is not limited to Indian habitations, ceremonial sites, abandoned settlements, treasure trove, artifacts, or other objects with intrinsic archaeological value and that relate to the history and culture of the State of Michigan.

**As-Planned Schedule**– The **Contractor's** Revision 0 Progress Schedule returned to the **Contractor** as "Resubmittal Not Required," with or without comments or objections noted.

**Authorized Technical Data**– Information and data contained in a report of exploration and tests of subsurface conditions that are expressly designated in paragraph 2.0 of Section 00210 Information for Bidders. Also, any physical data (dimension, location, conditions, etc.) contained in those drawings of physical conditions of existing surface and subsurface facilities identified in paragraph 3.0 of Section 00210 Information for Bidders.

**Bar Chart Schedule**– Activity schedule, in a bar chart format, that accounts for the entire Work at a level of detail

commensurate with the Progress Schedule requirements of the Contract Documents.

**STATE OF MICHIGAN MODEL**

Developed from FORMSPEC™ Michigan Model.

**Bid**– Written offer by a Bidder for the Work, as specified, which designates the Bidder's Base Bid and Bid Prices for all Alternates. The term *Bid* includes a *Rebid*.

**Bidder**– The Person acting directly, or through an authorized representative, who submits a Bid directly to the **Owner**.

**Bidding Documents**– The proposed Contract Documents as advertised, and all Addenda issued before Bid opening, and after Bid opening, if the Work is rebid without readvertising.

**Bid Price**– The Bidder's price for a lump sum item of Work, or the product of the Bidder's unit price for an item of Unit Price Work times the quantity given on the Bid Form for that item.

**Bid Security**– A security serving as a guarantee that the Bidder will conform to all conditions requisite for its return or as liquidated damages in the event of failure or refusal to conform.

**Bidding Requirements**– The Advertisement, Instructions to Bidders (including Attachment A), Supplementary Instructions, Information for Bidders, Bid Form, Bid Form Attachments and Qualification Submittals, as advertised and as modified by Addenda, and any other Section included within Division 0 of the Bidding Documents for the purpose of governing bidding and award of the Contract.

**\*AD Board**– The Administrative Board of the State of Michigan.

**Bonds**– Section 00310 Bid Bond, Section 00610 Performance Bond and Section 00620 Payment Bond are security furnished by the **Contractor**, as required by the Contract Documents.

**Business Day**– Any Day except Saturdays, Sundays and holidays observed by the **Owner**.

**Bulletin**– A standard **DTMB** or other **PSC** form used by the **PSC & Owner** to describe a change in the Work under consideration by the **Owner** and to request the **Contractor** to submit a proposal for the corresponding adjustment in Contract Price and/or Contract Time, if any.

**Calendar Day**– Every day shown on the calendar, Saturdays, Sundays, and holidays included.

**Cash Allowance**– An **Owner**-specified sum included within the Contract Price to reimburse the **Contractor** for the actual purchase/furnished cost of materials and/or equipment or other designated items, as specifically provided in the Contract Documents. Although the scope (e.g., the required quantity) of any Work covered by a Cash Allowance is sufficiently

detailed in the Contract Documents for the purposes of bidding the required labor costs, Subcontract costs, construction equipment costs and general conditions costs and Fee, it is understood that the required materials, equipment or other designated items are of uncertain purchase cost at the time of Bid or are yet to be specified in more detail by the **Professional** as to quality, appearance, durability, finish and such other necessary features affecting purchase price.

**Change Authorization**– A written order issued and signed by the **Professional**, which directs changes in the Work that require no adjustment in Contract Price or Contract Time, or which allows for variations in the quantities of Unit Price Work.

**Change Order**– A written order issued and signed by the **Owner**, which amends the Contract Documents for changes in the Work or an adjustment in Contract Price and/or Contract Time, or both.

**Contact Person**– Individual in the employ of the **Professional** or the **Owner** who is designated as the sole point of contact for prospective Bidders for requests or inquiries concerning the Work and/or the Bidding Documents.

**Contract**– Refer to the definition in paragraph 1.1 of Section 00500 Agreement. The term “Contract” encompasses the legal obligations of the **Owner** and **Contractor**, as defined by the Contract Documents.

**Contract Award**– The official action of the **Board**, the **Director-SFA** or the **Director-DCD** awarding the Contract to the **Contractor**.

**Contract Documents**– Those documents itemized or designated in paragraphs 2.2 through 2.4 of Section 00500 Agreement.

**Contract Float**– Calendar Days between the **Contractor's** anticipated date for early completion of the Work, or of a specified portion of the Work, if any, and the corresponding Contract Time.

**Contract Price**– The Contract price for the Work, or a designated portion of the Work, as designated in Section 00500 Agreement or elsewhere in the Contract Documents, is the total compensation, including authorized adjustments, payable by the **Owner** to the **Contractor** (subject to provisions for Unit Price Work).

**Contract Times**– The Contract Times for the entire Work are the periods allowed, including authorized adjustments, for Substantial Completion and final completion of the Work. The Contract Times for a designated portion of the Work are the periods allowed for Substantial Completion and final completion of any such portion of the Work, as specified in the Contract Documents.

**Contractor**– Person named “the **Contractor**” in Section 00500 Agreement with whom the **Owner** has entered into the Contract.

**Correction Period**– The period during which the **Contractor** shall, in accordance with the Contract Documents, (a) correct

or, if rejected, remove, and replace Defective Work, and (b) maintain warranties for materials and equipment in full force and effect.

**Cost of the Work Involved**– The sum of all costs that would be, or were, necessarily incurred by the **Contractor** in providing any Work Involved with the related change, less the costs that would be, or would have been, incurred by the **Contractor** to provide such Work without the related change.

**CPM Schedule**– Computerized, Activity-based Progress Schedule, using Critical Path Method (CPM) techniques, and accounting for the entire Work at a level of detail commensurate with the Progress Schedule requirements of the Contract Documents.

**Critical Path Method (CPM)**– The Critical Path Method of planning and scheduling. The term “Critical Path” denotes a sequence of Activities controlling achievement of a specified Contract Time.

**Date of Commencement of the Contract Time**– The date when the Contract Time starts to run.

**Defective**– An adjective which when referring to or when applied to the term “Work” refers to (a) Work not conforming to the Contract Documents or not meeting the requirements of any inspection, test, or approval, or (b) Work itemized in a Punch List which the **Contractor** fails to complete or correct within a reasonable time after issuance of the Punch List by the **Professional**.

**Defective Work/Non-Compliance Notice** – A DTMB-0499 form or equivalent issued to identify defective or non-compliant conditions requiring response and remedy by the **Contractor**.

**Delay**– Any act or omission or other event that in any manner adversely affects or alters the schedule, progress or completion of all or any part of the Work. Delay is a generic term intended to include deferral, stoppage, slow down, interruption and extended performance, and all related hindrance, rescheduling, disruption, interference, inefficiency and productivity and production losses.

**\*Department (DTMB)**– Department of Technology, Management and Budget of the State of Michigan. **Director** is the Director of the **Department**.

**Director-SFA**- The Director of **DTMB** State Facilities Administration.

**Director-DCD**- The Director of **DTMB** State Facilities Administration, **Design and Construction Division**

**Division**– Each of the numbered, distinct parts (starting with Division 0) into which the Specifications are divided.

**Drawings**– Part of the Contract Documents showing the Work. Drawings shall neither serve nor be used as Shop Drawings.

**Early (Late) Dates**– Early (late) times of performance for the Activities.

*Emergency*– A condition affecting the safety or protection of persons, or the Work, or property at or adjacent to the site.

*Fee for the Work Involved (Fee)*– A negotiated, percentage mark-up on the Cost of the Work Involved which is allowed to the **Contractor** for (a) reasonable administrative costs, and (b) negotiated, reasonable profit on the Cost of the Work Involved.

*General Requirements*– Division 1 of the Specifications.

*Hazardous Material*– Asbestos, ACBMs, PCBs, petroleum products, such construction materials as paint thinners, solvents, gasoline, oil, etc., and any other like material the manufacture, use, treatment, storage, transportation, or disposal of which is regulated by federal, State, or local Laws governing the protection of public health, natural resources, or the environment.

*State Facilities Administration*– Entity in the **Department** of Technology, Management and Budget responsible for design, construction, and operations and maintenance of facilities and capital renewal.

*State Facilities Administration Representative*– Designated DTMB-SFA **Design and Construction Division Project Director** (a) Responsible for directing and supervising the **Professional's** services during the period allowed for completion of the Work; and/or (b) Acting as representative for the **Owner** and for the enforcement of the Contract Documents, approving payment to the **Contractor** and coordinating the activities of the State, **Owner**, **Professional** and **Contractor**.

*Law(s)*– Means federal, state, and local statutes, ordinances, orders, rules and/or regulations.

*MCL*– The Michigan Compiled Laws of the State of Michigan.

*Means and Methods*– Includes means, methods, techniques, sequences and/or procedures applicable to the Work.

*Notice of Award*– Written notice accepting the Bid to the lowest responsive, responsible Bidder and designating the Contract Price (and establishing the Alternates accepted by the **Owner**).

*Notice to Proceed*– Written notice authorizing the **Contractor** to proceed with the Work, or a designated portion of the Work, and establishing the Date of Commencement of the Contract Time.

*On-Site Inspection*– The **Professional's** on-site examination of the **Contractor's** completed or in progress Work to determine and verify to the **State Facilities Administration Representative** that the quantity and quality of all Work is in accordance with the requirements of the Contract Documents.

*Owner*– The State of Michigan, named "the **Owner**" in Section 00500 Agreement, with whom the **Contractor** has entered into the Contract and for whom the Work is to be provided. The State of Michigan includes its departments, agencies, boards, commissions, officers, employees, and agents.

*Partial Use*– The use, by the **Owner**, of a designated portion of the Work before accomplishing Substantial Completion of the entire Work. Partial Use does not implicate or refer to Substantial Completion of the portion of the Work placed in use by the **Owner**.

*Person*– Individuals, partnerships, corporations, receivers, trustees, joint ventures, and any combinations of any of them.

*Political Subdivision*– Any county, city, village, or other local unit of the State, including any agency, department, or instrumentality of any such county, city, village, or other local unit.

*Pre-Award Schedule*– A Qualification Submittal required of the Apparent Low Bidder before Contract Award, and which is used by the **Owner** in the evaluation of the Apparent Low Bidder's Bid.

*Professional Services Contractor (Professional)*– The Person or its authorized representative licensed to practice architecture and/or engineering, named as "**Professional**" in Section 00500 Agreement, who has the right and authority assigned in the Contract Documents. The term **Professional** includes the **Professional's** consultants practicing the disciplines required by the Contract Documents. If the **Owner** will function as the **Professional**, such information will be noted in Section 00800 Supplementary Conditions or at the pre-construction conference.

*Progress Schedule*– Work Schedule that shows the **Contractor's** approach to planning, scheduling, and execution of the Work and that accurately portrays completed Work as to sequencing and timing, as provided in the Contract Documents.

*Project*– The total construction, which includes the Work and possibly other work, as indicated in the Contract Documents.

*Project Field Representative*– A **DTMB-SFA Design and Construction** employee or consultant, acting in collaboration and with direction from the **DTMB-SFA-DCD Project Director**, providing on-site, periodic observation and documentation of the Work for compliance with the Contract Documents.

*Project Manual*– The Book of Specifications, containing Division 0 of the Specifications and the technical Specifications.

*Provisionary or Contingency Allowance*– An amount included within the Contract Price to reimburse the **Contractor** for the cost to furnish and perform Work that is uncertain, i.e., may not be required, or is of indeterminate scope, i.e., design information and quantities, complexity, etc. are neither shown nor detailed in the Contract Documents. Work authorized under any Provisionary Allowance may consist of (a) changes required by actual conditions, as determined by the **Professional**, that are incorporated into the Work in accordance with Section 00700 General Conditions, and (b) any other Work authorized and completed under the pertinent provisions of the Contract Documents. Unlike a Cash Allowance, payments under a Provisionary Allowance shall include not only the purchase/furnished cost of the materials

and equipment involved, but also all related labor costs, Subcontract costs, construction equipment costs, general conditions costs and Fee, provided they are calculated in accordance with the requirements of Articles 10 and 11 of Section 00700 General Conditions.

**Public Utility**– Any utility company, utility department or agency of a Political Subdivision, natural gas pipeline company, cable TV company, or any other owner/operator of utilities that are operated or maintained in, on, under, over or across public right-of-way or public or private easements and which is defined as “Public Utility” under the provisions of 1974 PA 53, as amended, MCL 460.701.

**Punch List**– A list of minor items to be completed or corrected by the **Contractor**, any one of which do not materially impair the use of the Work, or the portion of the Work inspected, for its intended purpose. A Punch List shall be prepared by the **Professional** upon having decided that the Work, or portion of the Work inspected, is substantially complete and shall be attached to the respective certificate of Substantial Completion.

**Qualification Submittals**– Data concerning a Bidder's qualifications and eligibility, as specified in the Bidding Requirements.

**Rebid**– A revised or new Bid submitted by a Bidder on the Section 00300 Bid Summary and Bid Form and the Bid Form Attachments made available through post-Bid Addenda, in the event the Work is rebid without readvertising, as allowed by post-Bid Addenda.

**Record Documents**– Drawings, Specifications, Addenda, Change Orders, Change Authorizations, Bulletins, inspection, test and approval documentation, photographs, written clarifications and interpretations and all other documents recording, or annotated to show, all revisions and deviations between the as-built installation and the Contract Documents, all approved Submittals and all clarifications and interpretations.

**Records**– Books, reports, documents, and other evidence relating to the bidding, award and furnishing and performance of the Work.

**Record Schedule**– A Progress Schedule Revision Submittal returned to the **Contractor** as “Resubmittal Not Required,” with or without comments or objections noted.

**\*Recycled Material**– Recycled paper products, structural materials made from recycled plastics, refined lubricating oils, reclaimed solvents, recycled asphalt and concrete, recycled glass products, retreaded tires, ferrous metals containing recycled scrap metals and all other materials that contain (a) waste materials generated by a business or consumer, (b) materials that have served their intended purpose, and/or (c) materials that have been separated from solid waste for collection, recycling and disposition in the percentage determined by the State as provided by Law.

**Request for Payment**– The form provided by the **Owner** (Payment Request DMB-440) to be used by the **Contractor** in requesting payment for Work completed, which shall enclose

all supporting information required by the Contract Documents.

**Resident Project Representative**– The authorized representative of the **Professional** who is assigned to the site.

**Schedule of Values**– A schedule of pay items, which subdivides the Work into its various parts and which details, for each itemized part, cost and pricing information required for making payments for Work performed. The sum of all pay item costs in the Schedule of Values shall equal the Contract Price for the Work.

**Shop Drawings**– Includes drawings, diagrams, illustrations, standard schedules, performance charts, instructions and other data prepared by or for the **Contractor** to illustrate some part of the Work, or by a Supplier and submitted by the **Contractor** to illustrate items of material or equipment.

**Soil Erosion and Sedimentation Control**– The planning, design and installation of appropriate Best Management Practices designed and engineered specifically to reduce or eliminate the off-site migration of soils via water runoff, wind, vehicle tracking, etc. Soil erosion and sedimentation control in the State of Michigan is regulated under The Natural Resources Environmental Protection Act; Soil Erosion and Sedimentation Control, 1994 PA 451, Part 91, as amended, MCL 324.9101 et seq. Soil erosion and sedimentation control associated with this Contract is monitored and enforced by the **Department** of Technology, Management and Budget, State Facilities Administration.

**Specifications**– Parts of the Contract Documents organized into Divisions. “Technical Specifications” means Divisions of the Specifications consisting of technical descriptions of materials, equipment, construction systems, standards, and workmanship.

**State**– The State of Michigan in its governmental capacity, including its departments, agencies, boards, commissions, officers, employees, and agents. Non-capitalized references to a state refer to a state other than the State of Michigan.

**\*State Construction Code**– The Michigan State Construction Code Act, 1972 PA 230, as amended, MCL 125.1501 et seq.

**Sub agreement**– A subcontract or purchase order awarding a part of the Work to a Subcontractor or Supplier.

**Subcontractor**– A Person having a Sub agreement for providing labor at the site, or for providing labor at the site and furnishing materials and/or equipment for incorporation into the Work.

**Submittals**– Includes technical Submittals, Progress Schedules and those other documents required for submission by the Contract Documents. The term “technical Submittal” includes Shop Drawings, brochures, samples, Operation and Maintenance (O&M) Manuals, test procedures and any other Submittal the Contract Documents require the **Contractor** to submit to demonstrate how the items covered, after installation or incorporation into the Work, will conform to the information given in the Contract Documents and be

compatible with the design of the completed Work as a functioning whole as indicated in the Contract Documents.

**Substantial Completion**– The Work, or a portion of the Work designated in the Contract Documents as eligible for separate Substantial Completion, has been completed in accordance with the Contract Documents, to the extent that the **Owner** can use or occupy the entire Work, or the designated portion of the Work, for the use intended without any outstanding, concurrent Work at the site, except as may be required to complete or correct Punch List items. Prerequisites for Substantial Completion, over and above the extent of Work completion required, include (a) receipt by the **Owner** of operating and maintenance documentation, (b) all systems have been successfully tested and demonstrated by the **Contractor** for their intended use, and (c) the **Owner** having received all required certifications and/or occupancy approvals from the State and those Political Subdivisions having jurisdiction over the Work. Receipt of all certifications and/or occupancy approvals from those Political Subdivisions with jurisdiction in and of itself does not necessarily connote Substantial Completion.

**Supplementary Conditions**– Section 00800 within Division 0 of the Specifications that amends and/or supplements Section 00700 General Conditions and other designated Contract Documents.

**Supplementary Instructions**– Section 00120 within Division 0 of the Specifications that amends and/or supplements Section 00100 Instructions to Bidders and any other designated Bidding Requirement.

**Supplier**– A manufacturer or fabricator, or a distributor, material man or vendor representing a manufacturer or fabricator, who has a Sub agreement for furnishing materials and/or equipment.

**Target**– A point of progress for a key part of the Work, which is identified for monitoring progress of the Work. Target Times are not Contract Times.

**Total Float**– Number of Calendar Days by which the Work or any part of the Work may be delayed from its Early Dates without necessarily causing an overrun in a pertinent Contract Time. Total Float is by definition at least equal to Contract Float.

**Underground Utilities**– Pipelines, piping, conduit, duct, cables, wells, tanks, tunnels and appurtenances, or other similar facilities, installed underground to convey or support conveyance of potable water, sprinkler or irrigation water, fire protection systems, electricity, gases, steam, petroleum products, sewerage and drainage removal, telephone, communications, cable TV, traffic, or control systems.

**Unit Price Work, Contingent**– Work involving specified but undefined quantities (i.e., related Work quantities are not detailed in the Contract Documents) which when performed is

measured by the **Professional** and paid using the measured quantities and unit prices contained in the Contract Documents. Performance of such Unit Price Work is contingent upon conditions encountered at the site, as determined, and authorized by the **Professional**.

**Unit Price Work, Specified**– Work of specified and defined quantities (i.e., quantities are detailed in, and can be taken-off from, the Contract Documents) that when performed is measured by the **Professional** and paid based on the measured quantities and unit prices contained in the Contract Documents.

**Work (as in “the Work,” “the entire Work)**– The entire *completed Construction* required by the Contract Documents. The Work results from furnishing and performing all services, obligations, responsibilities, management, supervision, labor, materials, equipment, construction equipment, general conditions, permits, taxes, patent fees and royalties, testing, inspection and approval responsibilities, warranties, temporary facilities, small tools, field supplies, Bonds, insurance, mobilization, close-out, overhead and all connections, devices and incidental items of any kind or nature required and/or made necessary by the Contract Documents.

**Work Involved, any Work Involved**–Existing or prospective Work (a) reflected in any notice, proposal, or claim, or (b) reflected in changes ordered or in process, or (c) affected by Delay.

1.1.2. Other defined terms used in Division 0 but not assigned intent and meanings in this Section 00020 Glossary have the intent and meanings set forth in MCL or Section 00800 Supplementary Conditions.

1.1.3. Terms defined in this Section 00020 Glossary and used in other Specifications and/or in the Drawings in lower cases, or as capitalized terms, have the intent and meanings assigned to them in this Section 00020 Glossary if the context will permit.

## 1.2 Division 0 Rules of Construction:

1.2.1. Each Article in a Section in Division 0 contains “sub-articles,” numbered as this sub-article 1.2 is numbered; “parts,” numbered as this part 1.2.1 is numbered, and “sub-parts,” all of which are considered “paragraphs.” A reference to a paragraph means a reference to the sub-article, part or sub-part, or any combination of any of them, if the context will permit.

1.2.2. Any reference to an Article or a paragraph in a Section within Division 0 means a reference to an Article or a paragraph in the very Section in which the reference is made, unless that reference specifically names another Section.

1.2.3. Whenever the context of any provision requires, the singular number includes the plural number and vice versa, and the use of any gender includes all genders

## END OF SECTION 00020

**SECTION 00030 ADVERTISEMENT**

**1. Invitation to Bid (ITB)** – Your firm is invited to submit a Bid. The State of Michigan as the Owner will receive bids electronically through the SIGMA VSS website at <https://sigma.michigan.gov/webapp/PRDVSS2X1/AltSelfService> until 2:00 p.m., local time, on 10/4/2023. The State reserves the right to cancel this Invitation to Bid (ITB) or change the date and time for submitting Bids by announcing same at any time before the established date and time for Bid opening. Bids must remain open for acceptance by the Owner for no less than the Bid hold period. Contractor may agree to extend the Bid hold period. However, any such extension must be based upon no increase in the Bid Price and/or Contract Time.

**2. Work Description** – The Work, Create Kitchen, Agency No. 491, File No. 20167.SDW includes, but is not necessarily limited to construction of new kitchen and dining facility for the Center for Forensic Psychiatry. The site is located at 8303 Platt Road, Saline, Michigan, as shown on the Drawings. The Scope of work includes finishing the site upgrades and service drive to the existing campus while maintaining and modifying existing security fence system, The new kitchen and dining facility is connected to the existing building with fire rated barriers. The building will be fully occupied throughout the duration of the construction, Temporary barriers and egress will be required All kitchen equipment is included in the scope.

**3. Bidding Documents** – Sets of Bidding Documents may be obtained at:  
<https://sigma.michigan.gov/webapp/PRDVSS2X1/AltSelfService>

**4. Bid Security** – Each Bid shall enclose Bid Security, as specified in Section 00100 Instructions to Bidders (and as specified in Section 00310 Bid Bond, if a Bid Bond is enclosed), in the amount of five percent (5%) of the Bidder's Base Bid. If Bid Security is by check or money order, such certified or cashier's check or money order must be delivered in original copy before the Bid Due Time to:

State Facilities Administration  
Design & Construction Division  
3111 W. St. Joseph Street  
Lansing, Michigan 48917

*All other Bid information must be submitted via SIGMA as per standard bidding procedure.*

**5. Pre-Bid Conference** – A mandatory  voluntary  pre-bid conference will be held at 8303 Platt Rd, Saline, MI on 9/20/2023 at 11:00 am Local Time. A tour will  will not  be held on the same day, starting at 11:00 am local time. All prospective Bidders and other parties interested in the Work are required  encouraged  to attend the tour, if held. Addenda may be issued, in response to issues raised at the pre-bid conference and tour, or as the Owner and/or Professional may otherwise consider necessary.

An individual is only permitted to represent one bidder at a mandatory Pre-Bid Conference.

**FOR CORRECTIONAL FACILITIES ONLY:** All contractor/vendor representatives attending a Pre-Bid Walk Through Meeting must submit a Vendor/Contractor LEIN Request five business days prior to the meeting date, (Lein Request For CAJ-1037 attached to Bid posting). Send the LEIN Request form, filled out and signed, by email to Daniel T. Smith at email address: [SmithD76@michigan.gov](mailto:SmithD76@michigan.gov). The email "Subject" must include ("PSC edit for specific project" Facility Name, Project Name, Date & Time of Pre-Bid Walk Through Meeting).

**6. SIGMA VENDOR NUMBER:** If you are bidding a State job for the first time, visit the State of Michigan SIGMA website, <https://sigma.michigan.gov/webapp/PRDVSS2X1/AltSelfService>, and follow the "SOM VSS User Guide for New Vendors" instructions, located under Forms and Reference Documents. Registration is required for bid submission. **Do not wait until the last minute to submit a proposal**, as the SIGMA system requires the creation of an account and entry of certain information, in addition to uploading and submitting the materials. The SIGMA system **will not** allow a proposal to be submitted after the proposal deadline, even if a portion of the proposal has been updated.

Questions on how to submit information or how to navigate in the SIGMA VSS system can be answered by calling (517) 373-4111 or (888) 734-9749.

**7. Equal Employment Opportunity** – Covenants not to discriminate in employment by contractors, subcontractors and suppliers required by Law are contained in paragraph 14.12 of Section 00100 Instructions to Bidders and paragraph 7.12 of Section 00700 General Conditions and are applicable to the Work and any Subagreement under the Contract.

**8. Contract Times** – The Contract Times and the associated liquidated damages are specified in Article 4 of Section 00500 Agreement.

**9. Contact Person** – All requests or inquiries concerning the Bidding Documents or the Work shall be addressed to WTA Architects, 100 S. Jefferson Ave, Suite 601, Saginaw, MI 48607, Cariann Davitt Schartow, (989) 752-8107, [cschartow@wtaarch.com](mailto:cschartow@wtaarch.com).

**10. Award** – Subject to any agreed extension of the period for holding Bids, Bids shall remain valid for acceptance by the Owner for Sixty (60) Calendar Days after the date of Bid opening. In addition, the Owner expressly reserves the right, within the Owner's sole discretion, to reject any or all Bids, to waive any irregularities, to issue post-Bid Addenda and rebid the Work without re-advertising, to re-advertise for Bids, to withhold the award for any reason the Owner determines and/or to take any other appropriate action

**END OF SECTION 00030**

**SECTION 00100 INSTRUCTIONS TO BIDDERS**

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**STATE OF MICHIGAN MODEL**

Developed from FORMSPEC™ Michigan Model.

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**ARTICLE 1 BIDDING DOCUMENT INTERPRETATIONS**

1.1. Section 00020 Glossary assigns specific intent and meanings to capitalized terms and to other defined terms used in Section 00030 Advertisement, this Section 00100 Instructions to Bidders and Section 00210 Information for Bidders. The Glossary also provides specific rules for construing any reference to any Article or paragraph that is made in this Section 00100.

1.2. The deadlines and submission requirements imposed on the Bidders by the provisions of Articles 3 and 4 also shall apply to any prospective subcontractor or supplier seeking access to the site or needing to submit written questions or inquiries.

1.3. Except as otherwise noted, the deadlines and other requirements imposed upon the "Apparent Low Bidder" by the provisions of Articles 2, 5, 8 and 13 also shall apply to any other Bidder remaining or wishing to remain in contention for the award.

1.4. Neither the **Owner** nor **Professional** assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents in preparing Bids. The **Owner** and **Professional** make Bidding Documents available only for obtaining Bids, and neither the **Owner** nor **Professional** grants a license for any other use of the Bidding Documents.

**ARTICLE 2 QUALIFICATIONS OF BIDDERS**

2.1. The Apparent Low Bidder shall submit to the **Professional**, within two (2) Business Days after receipt of the **Professional's** request, Section 00430 List of Subcontractors. The Apparent Low Bidder also shall submit to the **Professional**, within five (5) Calendar Days after the **Professional's** request, a Pre-Award Schedule and those other Qualification Submittals noted in Sections 00410, 00420 and 00440. The Apparent Low Bidder(s) may be required to attend a pre-award conference(s).

2.2. The Pre-Award Schedule shall consist of a time-scaled CPM Schedule or a Bar Chart Schedule, as designated by the **Professional**. The Pre-Award Schedule shall (a) identify start and completion dates for the Work in summary form, (b) show the sequencing in which the Bidder plans to perform the Work to conform to the Contract Times and sequences of Work indicated in or required by the Bidding Documents, and (c) include a plot with percentages of completion for the Work correlating to the start and completion dates.

2.3. Unless otherwise determined by the **Owner**, in its sole discretion, failure, neglect or refusal by the Apparent Low Bidder to submit Qualification Submittals when and as requested justifies the **Owner's** refusal to consider the Apparent Low Bidder's Bid and the Apparent Low Bidder's Bid Security will be forfeited to the **Owner** as liquidated damages. However, in the case of any other Bidder remaining or wishing to remain in contention for the award, such failure, neglect, or refusal will not constitute grounds for forfeiting that other Bidder's Bid Security.



**ARTICLE 3 BIDDING DOCUMENTS; SITE CONDITIONS. SAFETY REQUIREMENTS; LAWS**

3.1. It is the responsibility of each Bidder, before submitting a Bid, to: (a) examine the Bidding Documents thoroughly; (b) visit the site and, if necessary, record conditions at the site (through logs/notes, photographs, video or any other means); (c) study and correlate the Bidder's observations with the Bidding Documents; and (d) submit written questions or inquiries about the Bidding Documents or the Work, as provided in Article 4, immediately after discovering any conflicts, ambiguities, errors or omissions in the Bidding Documents.

3.2. It is also the responsibility of each Bidder, in the preparation of its Bid, to take those steps that are reasonably necessary to (a) ascertain and satisfy itself of the physical conditions under which the Work will be performed and the condition of existing facilities, including those which may not be a part of the Work, but could be affected by the performance of the Work, and (b) account for all general, local and prevailing conditions at or near the site that may in any manner affect the cost, schedule, progress, performance or furnishing of the Work. Examples of such conditions include, but are not limited to: (a) the nature and location of the Work; (b) conditions related to the transportation, disposal, handling and storage of materials; (c) the availability and suitability of labor, materials, water, electric power, telephone, sanitary services and roads; (d) daily and monthly weather variations, including any related subsurface conditions, river stages, or similar conditions; (e) the character, quality and quantity of surface and subsurface conditions at the site, including but not limited to ground water table variations, and the location, configuration and condition of existing facilities and Underground Utilities; (f) the character of equipment and facilities needed preliminary to and during Work performance; (g) conditions related to maintaining the uninterrupted operation/occupancy of existing services or facilities; and (h) the extent to which the nature, characteristics and use of any adjacent or nearby lands, rights-of-way and easements, and facilities (in all cases, inclusive of real and personal property) may affect the Bidder's activities.

3.3. It is the responsibility of each Bidder to inform itself of, and the Bidder awarded the Contract shall comply with, all applicable Laws, including, but not limited to Laws affecting cost, schedule, progress, performance or furnishing of the Work. Examples of those Laws include, but are not limited to, those relating to nondiscrimination in employment, prevailing wages, protection of public and employee health and safety, environmental protection, building codes, fire protection, grading and drainage, use of explosives, vehicular traffic, restoration of lands and property under the control of the State or a Political Subdivision, taxes, permits and licensing.

3.4. Section 00210 Information for Bidders identifies (a) reports of explorations and tests of subsurface conditions, and (b) drawings of physical conditions of existing surface and subsurface facilities that have been used by the **Professional** in the preparation of the Bidding Documents. Bidders may rely upon such expressly stated technical information and data contained in those reports which are expressly designated as Authorized Technical Data in Section 00210 Information for Bidders, but those reports and drawings are not part of the Bidding Documents.

3.4.1. Any conclusions or interpretations made by any Bidder based on such Authorized Technical Data shall be at the Bidder's own risk. Reliance by any Bidder on any Non-technical Information or Data, interpretations or opinions contained in those reports or drawings also shall be at the Bidder's own risk. The **Owner**, **Professional** and their respective consultants assume no responsibility for any understanding reached or representation made about subsurface conditions and physical conditions of existing facilities, except as otherwise expressly shown in or represented by the Authorized Technical Data made available.

3.4.2. Section 00210 Information for Bidders also identifies additional reports of explorations and tests of subsurface conditions and reference documents reflecting physical conditions of existing surface and subsurface facilities that have not been used by the **Professional** in the preparation of the Bidding Documents. Any such reports and documents are not part of the Bidding Documents and are made available solely to allow Bidders to have access to the same information available to the **Owner** and **Professional**. Neither the **Owner** nor **Professional** warrants the accuracy or completeness of any such information nor do they warrant that Section 00210 Information for Bidders identifies all such existing relevant reports and/or documents.

3.5. Section 00210 Information for Bidders also identifies information and data shown or indicated in the Bidding Documents or Underground Utility drawings about Underground Utilities. Such information and data about existing Underground Utilities is based on information and data obtained from record documents of previous construction or furnished to the **Owner** by the owners of those Underground Utilities or by others.

3.6. Section 00700 General Conditions contain provisions concerning (a) responsibilities for Underground Utilities, (b) changes that may be ordered because of incidents with differing site conditions, and (c) the adequacy and completeness of the Authorized Technical Data of subsurface conditions and existing subsurface and surface facilities made available to Bidders.

3.7. To the extent that any Bidder considers that additional Authorized Technical Data is necessary for determining its Bid, it is the responsibility of that Bidder to request from the **Owner** the necessary additional Authorized Technical Data. In the event the **Owner** does not have the requested additional Authorized Technical Data, it shall be the responsibility of the Bidder, at the Bidder's sole cost, to undertake reasonable examinations of the site and any other pertinent available information and data that the Bidder considers necessary for determining its Bid.

3.8. If requested by a Bidder at least seven (7) Calendar Days before the date of Bid opening (or as otherwise agreed to by the **Owner**), the **Owner** will provide access to the site, when and as designated by the **Owner**, to allow that Bidder to conduct those reasonable explorations and tests that Bidder considers necessary for preparation and submission of the Bidder's Bid. Any such explorations and/or tests conducted by that Bidder shall comply with the requirements of the **Owner**, any Public Utilities involved and any Political Subdivisions with jurisdiction. If access to the site is granted, that Bidder shall fill all holes and clean up and restore the site to its former

condition, to the **Owner's** satisfaction, upon completion of those explorations and/or tests.

3.9. The Bidder awarded the Contract shall be responsible for obtaining any lands, areas, properties, facilities, rights-of-way, and easements, in addition to those furnished by the **Owner**, that the Bidder considers necessary for temporary facilities, storage, disposal of spoil or waste material or any other similar purpose. Neither the **Owner** nor **Professional** assumes any responsibility for site conditions at any lands, areas, properties, facilities, rights-of-way, and easements obtained by any Bidder.

\*3.10. With respect to any earth disturbance associated with this Contract, the Bidder awarded the Contract shall comply with The Natural Resources and Environmental Protection Act; Soil Erosion and Sedimentation Control, 1994 PA 451 Part 91, as amended, MCL 324.9101 *et seq.* **State Facilities Administration** is the designated "Authorized Public Agency" under the provisions of Section 9110 of 1994 PA 451, Part 91 as amended.

3.11. Each Bid shall include and be deemed to have included all (a) Michigan sales and use taxes and other similar taxes applicable to the Work that are required by Law as of the date of Bid opening, and (b) the cost of all permits, approvals, licenses, and fees necessary for the commencement, prosecution, and completion of the Work. Section 00700 General Conditions contain provisions concerning responsibilities of the Bidder for sales and use taxes and other similar taxes and for obtaining permits, approvals, licenses, and fees applicable to the Work.

3.12. To the extent the **Owner** or **Professional** has knowledge of other work at the site, which may be ongoing during the period allowed for the Work, the Bidding Documents shall identify such other work. Before submitting a Bid, each Bidder shall evaluate: (a) the effect that any such other work operations (e.g., dewatering, blasting, etc.) may have on the Work, (b) related conditions and sequences of Work contained in the Bidding Documents, (c) the requirements for coordination and cooperation between the Work and other work, and (d) related Contract Times.

3.13. The submission of a Bid constitutes a binding representation by the Bidder that: (a) the Bidder has complied with every requirement of this Article and the Bidding Documents; (b) the Bidder has examined and agrees with the Progress Schedule requirements contained in the Specifications, including, but not limited to, requirements concerning the administration of early completion schedules; (c) without exception, the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and in accordance with those Means and Methods indicated in or required by the Bidding Documents; and (d) the Bidder considers the Bidding Documents to be sufficient in scope and detail to indicate a clear understanding of all terms and reasonably foreseeable conditions applicable to the Work, and how such terms and conditions may affect the cost, schedule, progress, performance and furnishing of the Work.

3.14. Any failure of a Bidder to take the actions described and acknowledged in this Article will not relieve that Bidder of the responsibility for (a) properly estimating the difficulty, cost of and schedule for successfully performing and

furnishing the Work, or (b) upon award, performing and furnishing the Work successfully at no increase in Contract Price or Contract Time.

3.15. Neither the **Owner** nor **Professional** assumes any responsibility for any conclusions or interpretations made by any Bidder based on the information made available by the Bidding Documents. Nor does the **Owner** or **Professional** assume any responsibility for any understanding reached or representation made about conditions that may in any way affect cost, schedule, progress, furnishing or performance of the Work, unless that understanding, or representation is expressly stated or indicated in the Bidding Documents (including written Addenda).

#### ARTICLE 4 INTERPRETATIONS; ADDENDA

4.1. All requests for clarification or interpretation of the Bidding Documents, all proposals for any modifications to the Bidding Documents, all requests for information and all other questions or inquiries about the Bidding Documents and/or the Work shall be submitted in writing to the Contact Person identified in Section 00030 Advertisement, Article 8. Requests or inquiries received less than seven (7) Calendar Days before the date of Bid opening will be answered only if (a) the response can be given through Addenda made available at least seventy-two (72) hours before Bid opening (counting Business Days only), (b) the Bid opening is postponed by Addendum, or (c) the Work is rebid without re-advertising following the issuance of post-Bid Addenda.

4.2. Any interpretation or clarification, modification to the Bidding Documents (whether by correction, addition, deletion, or other revision) and/or information given will be binding only if given by Addenda. Interpretations, clarifications, corrections, additions, deletions or other revisions or information given orally or in any other manner are not binding on the **Owner** and if relied upon by any Bidder, shall be relied upon at the Bidder's own risk. Addenda will be provided by posting to and may be obtained by bidders at: <https://sigma.michigan.gov/webapp/PRDVSS2X1/AltSelfService>

4.3. In the **Owner's** sole discretion, subsequent to the opening of Bids, post-Bid Addenda may be issued setting a new date for the receipt and opening of sealed Rebids.

4.4. Any quantities of Unit Price Work given on the Bid Form, whether detailed in the Drawings or Specifications or contingent upon actual conditions, are approximate only, and are to be used solely for comparing Bids and establishing the Contract Price. Neither the **Owner** nor **Professional** represents that the actual quantity for any item of Unit Price Work performed will equal the quantity given. Payments will be made only for actual quantities of Unit Price Work completed in accordance with the Contract Documents. Actual quantities of Unit Price Work may overrun or underrun those in the Bid Form without necessarily invalidating the unit prices bid (except as provided in paragraph 10.6 of Section 00700 General Conditions).

#### ARTICLE 5 BID SECURITY

5.1. Bid Security shall be made payable to the "State of Michigan" in the form of a certified or cashier's check or money

order drawn upon a bank insured by an agency of the Federal Government or consist of a duly executed Bid Bond. A Bid Bond shall be duly executed by the Bidder and by a surety authorized to do business in the State by the Department of Energy, Labor and Economic Growth and listed on the current U.S. Department of the Treasury Circular 570. Bidders shall attach a certified copy of Power of Attorney to sign Bid Bonds as the Attorney-in-Fact. Copies of the current Circular listing of approved bonding/insurance companies and interim changes may be obtained through the Internet web site <https://www.fiscal.treasury.gov/fsreports/ref/suretyBnd/c570.htm>.

5.2. Failure by a Bidder to enclose with its Bid a certified or cashier's check or money order or a duly executed Bid Bond signed by Bidder and Surety shall disqualify that Bidder from any consideration for the award. *If Bid Security is by check or money order, such certified or cashier's check or money order must be delivered in original copy before the Bid Due Time to:*

State Facilities Administration  
Design & Construction Division  
3111 W. St. Joseph Street  
Lansing, Michigan 48917

*All other Bid information must be submitted via SIGMA as per standard bidding procedure.*

5.3. The Bid Security of the Bidder recommended for award will be retained until that Bidder has fulfilled all the following: (a) submitted Qualification Submittals and required information, (b) executed and delivered Section 00500 Agreement, (c) delivered evidence of insurance, and (d) furnished the required Section 00610 Performance Bond and Section 00620 Payment Bond (including separate certifications). If that Bidder fails to do so when and as specified, the **Director-DCD or his/her designee**, may annul the Notice of Award recommendation, and the Bid Security of that Bidder will be forfeited to the **Owner** as liquidated damages. If the **Owner** incurs any collection costs in the enforcement of the Bid Security requirement, that Bidder and its surety, if any, agree jointly and severally to reimburse the **Owner's** costs of collection, which shall include reasonable fees and charges of attorneys and others, court or hearing costs incurred with or without suit and interest.

5.4. If the Apparent Low Bidder gives a certified or cashier's check or money order as Bid Security, and the **Owner** requests a certification by an acceptable surety stating that the Bidder will furnish the Section 00610 Performance Bond and Section 00620 Payment Bond if awarded the Contract, that Bidder shall furnish such certification within seven (7) Calendar Days after the **Owner's** request.

5.5. The Bid Securities of the Apparent Low Bidder and of any other Bidder remaining in contention for the award will be retained by the **Owner** until the end of the period during which Bids shall remain open, or seven (7) Calendar Days after the **Owner** executes Section 00500 Agreement, whichever last occurs.

#### **ARTICLE 6 CONTRACT TIME; LIQUIDATED DAMAGES**

6.1. The Contract Times, i.e., the number of Calendar Days within, or dates by, which the Work or any part of the Work shall be completed, are specified in Section 00500

Agreement, and may be supplemented, as provided in Section 00500 Agreement. As stated in Section 00500 Agreement, the Contract Times are of the essence of the Contract. If any Bidder believes that any of the Contract Times are insufficient or excessive, that Bidder shall advise the **Owner** in accordance with the requirements of Article 4.

6.2. Liquidated damages are specified in Section 00500 Agreement and may be supplemented, as provided in Section 00500 Agreement.

#### **ARTICLE 7 MATERIALS AND EQUIPMENT**

7.1. Named or Specified Materials and Equipment – Materials and equipment described in the Specifications by naming a brand, make, supplier or manufacturer or by using a specification shall establish a standard and shall be intended to convey function, necessary design features, general style, type, materials of construction, character and quality, serviceability, and other essential characteristics. A number of Specifications, if any, using named or specified materials and equipment are *listed* in Schedule 1.6 of Section 00440 Schedule of Materials and Equipment.

7.2. Proposal for Adding Products by Addenda – For those Specifications *listed* in paragraph 1.6 in Section 00440 Schedule of Materials and Equipment, the **Professional** will, up to ten (10) Calendar Days before the date of Bid opening stated in Section 00030 Advertisement, accept written proposals from non-named manufacturers and suppliers seeking to have the **Professional** add their products to Schedule 1.6. The **Professional** will consent to any such proposal by Addendum if, in the **Professional's** judgment, the proposed material or equipment also may be used as a named or specified product. Lack of adequate time or information needed to evaluate a proposal, as determined in the sole discretion of the **Professional**, may justify its rejection.

7.2.1. Any such proposal shall clearly identify differences between the proposed and named or specified material or equipment and demonstrate objectively that the proposed material or equipment: (a) has the same essential characteristics of the item named or specified, (b) will equally perform the functions and achieve the results called for by the general design concept, (c) is suited to the same use as the item named or specified, (d) is at least of equal materials of construction, quality and necessary essential design features to the material or equipment named or specified, (e) conforms substantially to the desired detailed requirements, including, but not limited to durability, strength, appearance and aesthetics (if aesthetics are significant), safety, service, life, reliability, economy of operation and ease of maintenance, and (f) offers a proven record of performance and service for at least three (3) years before the date of Bid opening.

7.2.2. Any such proposal shall further include (a) a list of installations that have been in service for at least three (3) years before the date of Bid opening (including the name, address, and telephone number of a person familiar with and at the installation), and (b) sufficient drawings, diagrams, brochures, schedules, performance charts, instructions, samples, and other data as may be necessary to allow the **Professional** to make a determination.

7.3. Each Bidder is responsible for notifying the **Professional** in writing if the Bidder knows or has reason to know that any material or equipment *listed* in Section 00440 Schedule of Materials and Equipment, which the Bidder intends to bid requires changes in the Work. Any such notice shall be provided no later than seven (7) Calendar Days before Bid opening. This requirement applies but is not limited to changes in any testing requirements or Means and Methods indicated in or required by the Bidding Documents. However, this requirement is not intended to make the Bidder responsible for correcting design errors or omissions.

7.3.1. If any Bidder fails to provide such notice, and is awarded the Contract, that Bidder assumes responsibility for its proportionate share of any excess costs and Delay. *Excess* costs and Delay are those resulting from changes in the Work that would not have been incurred had that Bidder not failed to provide written notice to the **Professional**.

7.4. Bidding Requirement – For those Specifications *listed* in paragraph 1.6 of Section 00440 Schedule of Materials and Equipment, each Bidder shall bid one of the *listed* materials and equipment only. This requirement to not bid "or equal" or substitute materials and/or equipment for the *listed* Specifications applies even if the Bidding Documents state that an "or equal" or substitute may be furnished or used for any *listed* Specification.

7.5. Contract Condition – For those Specifications *listed* in paragraph 1.6 of Section 00440 Schedule of Materials and Equipment, the Contract will be awarded on the basis that only *listed* named or specified materials and equipment will be furnished. If an "or equal" or a substitute may be furnished for any *listed* Specification, if acceptable to the **Professional**, application for acceptance will not be considered until after Contract Award.

7.6. Section 00700 General Conditions contains provisions requiring each Supplier (a) to be bound to the requirements of the Contract Documents, (b) to assume toward the **Contractor** all obligations that the **Contractor** assumes toward the **Owner** and **Professional**, and (c) to furnish Work under a Sub-agreement containing waiver of rights of subrogation provisions.

## ARTICLE 8 SUBCONTRACTORS

8.1. For each Division, Section of the Specifications and/or trade itemized in Section 00430 List of Subcontractors, the Apparent Low Bidder shall, when requested by the **Professional**, nominate the Subcontractor(s) to be awarded a Sub-agreement(s). When completing Section 00430, the Apparent Low Bidder shall provide licensing data for trades for which contractors' licensing is required and, if applicable, indicate minority, woman, or handicapped status. One Subcontractor shall be nominated for each Specification or trade, unless the Apparent Low Bidder, directly or through a Subcontractor, intends to award more than one Sub-agreement for the listed Specification or trade.

8.2. If the **Owner** objects, for good cause, to any nominated Subcontractor, the **Owner**, before issuing the Notice of Award, may request replacement of that Subcontractor. In that event, the Apparent Low Bidder shall

nominate a substitute Subcontractor or the Bidder itself, if qualified for the Work involved. In such case, there will be no extension in the Bid hold period nor any increase in the Bidder's Bid or Alternates. If the Bidder declines, that Bidder shall not be recommended for the award; however, such declining will not constitute grounds for forfeiting the Bidder's Bid Security.

8.3. Except as provided in paragraph 8.2, no removal or replacement of a nominated Subcontractor will be considered by the **Owner**, except for good cause. Before Contract Award, any removal, replacement, or addition of a nominated Subcontractor shall be responsive to the requirements of the Bidding Documents only to the extent it permits the timely evaluation of the newly nominated Subcontractor. After Contract Award, if the Apparent Low Bidder, as the **Contractor**, nominates *for the first time* a Subcontractor for any Division, Specification and/or trade listed in Section 00430 List of Subcontractors, and the **Owner** objects for good cause to any such newly nominated Subcontractor, the **Contractor** shall provide a replacement Subcontractor at no increase in Contract Price and/or Contract Time.

8.4. Section 00700 General Conditions contains provisions requiring each Subcontractor (a) to be bound to the requirements of the Contract Documents, (b) to assume toward the **Contractor** all obligations that the **Contractor** assumes toward the **Owner** and **Professional**, and (c) to provide Work under a Sub-agreement containing waiver of rights of subrogation provisions.

8.5. These provisions shall not be construed to create any third-party beneficiary or joint employer status with respect to the **Owner** and/or **Professional** and any Subcontractor. Furthermore, these provisions shall not be construed to create or impose any duty or liability on the **Owner** to exercise this authority for the benefit of any Bidder, nominated or newly nominated Subcontractor or any other third party.

## ARTICLE 9 BID FORM AND BID FORM ATTACHMENTS

9.1. All bid forms should be uploaded as attachments to SIGMA, including the Section 00300 Bid Summary, Section 00300 Bid Form and Bid Form Attachments (Section 00310 Bid Bond Form and Section 00320 Non-collusion Affidavit. If any forms are revised by Addendum, the latest revision of the appropriate Bid Summary, Bid Form and/or Bid Form Attachment shall be used. All blank spaces shall be legibly and properly printed in ink or typed as required in these Instructions to Bidders and each form. All Bid prices shall be printed or typed in both words and figures.

9.2. Bids by individuals shall be signed by the person making that Bid, or the Bid shall enclose a Power of Attorney evidencing authority to sign the Bid in the individual's name.

9.3. Bids by partnerships shall be signed in the name of the partnership. The partner authorized to sign shall be named and sign where indicated. A certified copy of power of attorney authorizing that partner to bind all partners shall be attached to Section 00300 Bid Form. If a certified copy of the partnership's certificate attached to Section 00300 Bid Form indicates that all partners have signed, no separate authorization is required.

9.4. Bids by corporations shall be signed in the legal corporate name. The signature of the president or authorized officer shall be entered below the corporate name, followed by the attesting signature of the corporation secretary or of an authorized officer other than the officer signing the Bid. A certified copy of a pertinent Board Resolution authorizing that individual to bind the corporation shall be attached to Section 00300 Bid Form.

9.5. Bids by joint ventures shall be signed by all or one of the joint venturers. If not all joint venturers sign, a certified copy of Power of Attorney authorizing the individual(s) signing to bind all joint venturers shall be attached to Section 00300 Bid Form. If a certified copy of the joint venturer's certificate attached to Section 00300 Bid Form indicates that all joint venturers have signed, no separate authorization is required.

9.6. The Bidder shall acknowledge receipt of all Addenda by completing the blank spaces in the table provided for that purpose in paragraph 2.1 of Section 00300 Bid Form.

## **ARTICLE 10 PREPARATION AND SUBMISSION OF BIDS**

### **10.1. Left Blank Intentionally**

**10.2. Bids must be submitted electronically through the SIGMA VSS website at <https://sigma.michigan.gov/webapp/PRDVSS2X1/AltSelfService>**

10.3. Each bid requesting the Qualified Disabled Veterans (QDV) preference, in accordance with Public Act 22 of 2010, MCL 18.1241(3), shall include a DD 214 Proof of Service and Discharge, a Veterans Administration rating decision letter, proof of disability (if the disability is not indicated on the DD 214), and appropriate legal documents setting forth the 51% natural persons QDV ownership.

10.4. If Unit Price Work is specified, the Bidder shall, for each Unit Price Work item listed separately on Article 6 of Section 00300 Bid Form, bid a unit price, and enter, in the appropriate column, the computation of the respective quantity multiplied by the respective Bidder's bid unit price. Bid prices for each lump sum or "One Each" item listed on the Bid Form shall be printed or typed only in the appropriate "Bid Price" column. The Bidder shall show the sum representing the Bidder's Base Bid and, if Alternates are listed, the Bid prices for all Alternates, in the spaces provided for those purposes.

10.5. For each Cash Allowance, the Bidder shall include, within the Bid, all labor costs, construction equipment costs, insurance and Bond premiums and other general conditions costs and Fee (Bidder's and Subcontractors') to complete Work associated with the material, equipment, or other designated item to be furnished under the Cash Allowance. For each Provisionary/Contingency Allowance, the Bidder shall include, within the Bid, insurance premiums (not recoverable as labor burden) and Bond premiums required to complete Work that may be ordered under the Provisionary/Contingency Allowance. Cash Allowances and Provisionary/Contingency Allowances are defined in Section 00020 Glossary and are further described in paragraph 10.7 of Section 00700 General Conditions.

10.6. The Bidder's Base Bid and Alternate Bid prices shall include, and payment for completed Work shall be compensation in full for, all services, obligations, responsibilities, management, supervision, labor, materials, devices, equipment, construction equipment, general conditions, permits, patent fees and royalties, testing, inspection and approval responsibilities, warranties, temporary facilities, small tools, supplies, Bonds, insurance, taxes, mobilization, close-out, overhead and profit and all connections, appurtenances and any other incidental items of any kind or nature, as are necessary to complete the Work, in a neat, first quality, workmanlike and satisfactory manner in accordance with the Drawings and Specifications and as otherwise required to fulfill the requirements of the Bidding Documents.

10.7. Neither the Section 00300 Bid Form nor any Bid Form Attachment made available to the Bidders and submitted with the Bid shall be altered in any way. Bids shall not contain any qualifications or conditions or any recapitulations of the Work whatsoever. No Alternate will be considered, unless any such Alternate is itemized in paragraph 6.2 Schedule of Alternates in Section 00300 Bid Form and specified in the Bidding Documents.

10.8. Before and after Bid submission, and before the time for receiving Bids has expired, any Bidder may alter or revise any price or information the Bidder has entered on its Bid Form or any Bid Form Attachments by: (a) crossing out the entry, (b) legibly printing in ink or typing the new price or information, and (c) placing the initials of the person who signs the Bid adjacent to each change. After Bid opening, the **Owner** may require a Bidder to verify any such alteration or revision. Ambiguities arising from any alterations or revisions made by any Bidder may be resolved against that Bidder, in the **Owner's** sole discretion.

10.9. Neither the **Owner** nor **Professional** assumes any responsibility for any costs any Bidder incurs, however caused, in preparing and submitting its Bid, in withdrawing its Bid, or in objecting to the award or to being disqualified for the award.

10.10. In the event of any conflict between Attachment A to Section 00100–Bidder's Checklist and any requirements specified in any other parts of the Bidding Documents; the requirements of the Bidding Documents taken as a whole shall be binding on the Bidders.

10.11. All bonds, insurance, and other required documents shall be issued in the name of the bidder.

## **ARTICLE 11 BID WITHDRAWAL**

11.1. Any Bidder may withdraw its Bid before Bid opening by submitting to the **Owner** a document requesting the withdrawal in the manner in which a Bid shall be signed and submitted to the **Owner**. Withdrawal of a Bid before Bid opening will not prejudice the right of that Bidder to submit a new, modified Bid. After the time for receiving Bids has expired, the following will apply: (a) no Bid may be modified, altered, or reformed, except to resolve irregularities on the Bid Form or Bid Form Attachments, as provided in paragraph 14.6,



and (b) no Bid withdrawal will be accepted by the **Owner**, except as provided in paragraphs 11.2 through 11.6.

11.2. After the time for receiving Bids has expired, no Bid may be withdrawn, unless that Bidder lodges a written claim of a mathematical or clerical error in the Bidder's Bid with the **Owner** within two (2) Business Days after the date of Bid opening. The claim shall describe in detail the mathematical or clerical error, include a signed affidavit stating the facts of the alleged error and request that the Bidder be released from the Bidder's Bid.

11.3. If any Bidder's claim to withdraw its Bid due to an alleged mathematical or clerical error is timely filed, the **Director-DCD**, or his/her designee, will determine the validity of the claim and, as he/she deems necessary within his/her sole discretion, will provide an opportunity to the Bidder making the withdrawal to present its verification claim at a hearing/review session within ten (10) Calendar Days after the **Owner** received the claim.

11.4. At the Bid withdrawal claim review, the **Director-DCD**, or his/her designee shall, within his/her discretion, informally hear testimony and receive evidence as to whether (a) the Bid contains an obvious mathematical or clerical error not involving lack of good faith or fair dealing, (b) the error is subject to objective certification and is of such grave consequences that to enforce the Contract would be unconscionable, (c) the error relates to a material feature of the Contract, and (d) the error was not caused in any way by the Bidder's violation of positive legal duty or culpable negligence.

11.5. Upon completion of the claim review process and before any award recommendation, the **Director-DCD**, or his/her designee, will enter findings and render a determination on the Bidder's withdrawal claim. The **Owner** will notify the Bidder within a reasonable time after such determination.

11.6. If the **Director-DCD**, or his/her designee, concurs with the Bid withdrawal claim and the **Owner** suffers no serious prejudice, except loss of bargain, the **Owner** will allow the Bidder to withdraw its Bid will return the Bidder's Bid Security within a reasonable time. However, that Bidder will not be allowed to submit another Bid for the Work. The decision of the **Director-DCD**, or his/her designee, shall be final and binding on any such Bidder.

## **ARTICLE 12 BID OPENING; OBJECTION TO THE AWARD**

12.1. Each Bidder bears sole responsibility to submit their bid electronically through the SIGMA VSS website at <https://sigma.michigan.gov/webapp/PRDVSS2X1/AltSelfService>

12.2. Within reasonable time after the date of Bid opening, the **Owner** will make available a "Bid tabulation" listing the Bids opened and the Apparent Low Bidder. If any Bidder listed in the Bid tabulation has any objection to the Apparent Low Bidder, the objecting Bidder shall file a written protest with the **Owner** within seven (7) Calendar Days after the date of Bid opening. The protest shall describe in detail the basis for the protest and request a determination under this Article.

12.3. If a written protest is timely filed, the **Director-DCD**, or his/her designee, will review the protest and if he/she determines in his/her sole discretion that a claim review process is necessary, such proceeding shall be conducted within ten (10) Calendar Days after receipt of the written protest.

12.4. The **Owner** will notify the Bidders involved within a reasonable time of the **Director-DCD's**, or his/her designee's, recommendation to dismiss or uphold the protest. If the protest has been denied, the **Owner** will notify those Bidders of the time and date on which the **Board's** Building Committee will meet to consider the **Director-DCD's**, or his/her designee's recommendation of award. The objecting Bidder and the Apparent Low Bidder will be given an opportunity to be heard at the Building Committee meeting and, at the discretion of the **Board**, at any subsequent **Board** meetings. The Building Committee and **Board**, at its discretion, will review or hear the protest under such terms and conditions as either deems proper.

12.5. Upon reviewing the protest, the Building Committee and/or the **Board** will either (a) dismiss the protest, or (b) uphold the protest and send the Bid back to the **Director-DCD**, or his/her designee, for a new Bid evaluation or rebid, consistent with the determination of the Building Committee or **Board's** findings. The decision of **Board** as to the protest shall be final and binding.

## **ARTICLE 13 BIDS TO REMAIN OPEN**

13.1. Bids shall remain open for acceptance by the **Owner** for no less than the period during which Bids shall remain valid (i.e., the Bid hold period) stated in Section 00030 Advertisement.

13.2. The **Owner**, by written notice, may elect to request the Apparent Low Bidder and any other Bidder remaining or wishing to remain in contention for the award to hold their Bids beyond the Bid hold period. Any such Bidder who fails or refuses to agree to the **Owner**-requested extension may be disqualified for further consideration for the award. However, no such Bidder shall forfeit the Bidder's Bid Security due to its failure or refusal to hold its Bid.

13.3. Any such Bid hold extension request by the **Owner** and consent by any Bidder shall be based upon no increase in (a) the Bidder's Base Bid, (b) any of the Bidder's Alternate Bid Prices, and (c) any Contract Times stated in Calendar Days. However, in the event none of the Bidders involved consent to extending their Bids, as conditioned in this paragraph, the **Owner** will issue a post-Bid Addendum specifying an additional Alternate for the sought extension in the Bid hold period.

## **ARTICLE 14 AWARD OF THE CONTRACT**

14.1 If the Owner elects to award the Contract, the Owner will make the award to the responsive and responsible best value bidder except as provided below relative to veteran's preference.

14.1.1 The Apparent Low Bidders will be evaluated for responsiveness and responsibility based on the following:

- Compliance with the bid specifications and requirements.
- The Bidder's financial resources.
- The Bidder's technical capabilities.
- The Bidder's technical experience.
- The Bidder's past performance.
- The Bidder's insurance and bonding capacity.
- The Bidder's business integrity.

If a qualified disabled veteran meets the requirements of the contract solicitation, provides acceptable responses to both Part One and Part Two of the Best Value Construction Bidder Evaluation to achieve a Best Value recommendation and with the veteran's preference is the lowest responsive, responsible, best value Bidder the Owner will award the contract to the qualified disabled veteran bidder.

A determination as to whether the requirements of the bid solicitation have been met will be based solely on the Owner's and Professional's evaluation of the Section 00300 Bid Form, Bid Form Attachments, Bidder-provided documents, Best Value Evaluation by the PSC, interview, and Bidder Qualification Submittals received in a timely basis. Each bid requesting the Qualified Disabled Veterans (QDV) preference, in accordance with Public Act 22 of 2010, MCL 18.1241.3 shall include a DD 214 Proof of Service and Discharge, a Veterans Administration rating decision letter, proof of disability (if the disability is not indicated on the DD 214), and appropriate legal documents setting forth the 51% natural persons QDV ownership.

The bids will be evaluated for best value based on price and qualitative components by comparing the qualitative components of the three lowest responsive and responsible Bidders. The comparison may also include other Bidders whose bids are within 10% of the lowest responsive and responsible Bidder. Determination of the lowest three Bidders shall be based on the sum of the Base Bid and any additive and deductive Alternates the Owner accepts. Alternates shall be accepted in the order listed in paragraph 6.2 Schedule of Alternates in Section 00300 Bid Form only. The Owner will accept an Alternate only if all other previously listed Alternates are also accepted unless acceptance by the Owner of Alternates in a different order does not affect determination of the lowest three bidders in any way.

Some qualitative components that may be evaluated are:

- Technical approach.
- Quality of proposed personnel.
- Management plans.
- ADD ANY OTHER PROJECT SPECIFIC

For contracts under \$250,000, best value will primarily be based on the lowest responsive and responsible bid.

14.1.2. For determining the lowest, responsive, and responsible bid, when a Qualified Disabled Veterans (QDV) preference is requested, 10% of the lowest responsive and responsible bid (the bid that would otherwise receive the contract award if the preference were not being considered) will be deducted from all QDV bids. If the low responsive and responsible QDV bid, less the 10% preference, is less than the

lowest responsive and responsible bid, then the QDV bid will be declared the official lowest responsive and responsible bid. The original QDV bid amount will be the basis of the contract award.

14.1.3. Bid irregularities with respect to the Bidding Documents, for which corrective action is not already provided in paragraph 14.6 or elsewhere in the Bidding Documents, may be waived at the sole discretion of the **Owner**, unless the irregularity was due to the Bidder's lack of good faith or fair dealing, or where the waiver would lead to a determination obviously in error or inconsistent with the Bidding Documents.

14.1.4. For Bids over \$100,000.00, Bidders that self-certify to be a Michigan business shall be given a preference over an out of state Bidder in the same manner in which an out-of-state Bidder would be preferred in its home state. Bidders that neither self-certify as a Michigan business in their Bid nor authorize the Michigan Department of Treasury to release information necessary to verify entitlement will be deemed to have waived their right to claim entitlement to any preference.

14.2. No Bidder shall be considered responsible under the requirements of the Bidding Documents, unless that Bidder delivers the information required in paragraph 2.1 that the **Owner** considers necessary to the evaluation of the Bid.

14.3. The following may be considered examples of sufficient grounds for determining that a Bidder is not responsible, or for objecting to any of the Bidder's Subcontractors (even if holding a valid license) or Suppliers: \*(a) being listed on the Michigan Department of Labor's register of employers who have been found in contempt of court by a Federal Court of Appeals for failure to correct an unfair labor practice as prohibited by Section 8 of Chapter 372 of the National Labor Relations Act, 29 U.S.C. 158 (1980 PA No. 278, as amended, MCL 423.321 et seq.); \*(b) being debarred from participation in the bid process pursuant to Section 264 of 1984 PA 431, as amended, MCL 18.1264, or debarred or suspended from consideration for award of contracts by any other State or any federal Agency; (c) a felony conviction in any state (including this State) within the last three (3) years before the date of Bid opening; (d) lack of adequate experience or demonstrated qualifications or capability to perform the trades or classifications of the Work specified in the Bidding Documents; (e) reasonable doubt concerning the ability to maintain adequate construction equipment, quality control, schedule control or financing to meet contractual obligations under the Bidding Documents; (f) a previous termination for cause by the **Owner** within the last five (5) years before Bid opening; (g) failure to comply with all requirements for foreign corporations; (h) concealment, misrepresentation or misstatement of any material facts; or (i) failure to pay any federal, State or local taxes.

14.4 If the Owner, either through the Director-DCD or his/her designee, or the Board, intends to disqualify any Bidder under consideration for award, written notice of the impending disqualification will be provided by the Owner (including reasons for the disqualification) to that Bidder and those Bidders remaining under consideration to the award. If the disqualified Bidder has any objection to the disqualification that Bidder shall, within two (2) Business Days, file a written protest, as provided in paragraph 12.2, and follow the protest

procedures in paragraphs 12.3 through 12.5. The decision of the Board shall be final and binding on the disqualified Bidder.

14.5. Except in circumstances leading to a determination obviously in error or inconsistent with the Bidding Documents, irregularities on any Bid shall be resolved using the rules provided in paragraph 14.6. Except as stated in paragraph 14.6(e), any Bid Form and Bid Form Attachment having any such irregularity shall be modified, altered, or revised to reflect the resolution of the irregularity, however, no Bidder-provided sum or extension shall be modified, altered, or revised and the Bidder's Bid shall be binding on the Bidder and the Bidder's surety, subject to the provisions governing Bid withdrawals stipulated in Article 11.

14.6. The following irregularities on any Bid Form or Bid Form Attachment shall be resolved as follows: (a) between SIGMA entry and signed Bid Summary attachment, the signed Bid Summary attachment will be used; (b) between words and figures, the words shall be used; (c) between any sum, computed by the Bidder, and the correct sum, the sum computed by the Bidder shall be used; (d) between the product, computed by the Bidder, of any quantity and bid unit price and the correct product of the unit price and the quantity of Unit Price Work, the product extended by the Bidder shall be used; (e) between a stipulated Allowance and the amount entered, the Allowance shall be used; (f) any mobilization pay item exceeding the maximum specified shall be ignored and the Bid shall remain unchanged; (g) if any Bidder fails or neglects to bid a unit price for an item of Unit Price Work but shows a "Bid Price" for that item, the missing unit price shall be computed from the respective quantity and the Bid Price shown; (h) if any Bidder fails or neglects to show a "Bid Price" for an item of Unit Price Work but bids a unit price, the missing Bid Price shall remain as "zero"; and (i) if any Bidder fails or neglects to enter a Bid price in both words and figures, the Bid price printed or typed, whether in words or figures, shall be used.

14.7. If there are reasonable grounds for believing that collusion or unlawful agreements exist between any Bidders, that a Bidder is interested in more than one Bid, or that any Bids are not genuine, those Bidders will be disqualified, and their Bids will be rejected without consideration.

14.8. All costs of the Bidder awarded the Contract and that are incurred in responding to requests from the **Owner** or **Professional**, whether or not sufficient, shall neither justify any increase in Contract Price or Contract Time nor provide any basis for subsequent consideration by the **Owner** of a proposal or claim for any increase in Contract Price or Contract Time.

\*14.9. Michigan and Recycled Products – The Bidder awarded the Contract and all Subcontractors and Suppliers shall use (a) Michigan-made products whenever possible where price, quality and performance are equal to or better than non-Michigan products, and (b) supplies, materials and equipment made from Recycled Materials if there is a readily identifiable source or market as determined by the **Director-DCD, or his/her designee**, and the cost does not exceed one hundred ten percent (110%) of supplies, materials or equipment not containing Recycled Materials (Sections 261 and 261a of the Management and Budget Act, 1984 PA 431, as amended, MCL 18.1261 and MCL 18.1261a).

\*14.10. Subcontractor and Supplier Businesses Owned by Minorities, Women and Persons with Physical or Mental Disabilities – Bidders are urged to utilize as Subcontractors and Suppliers, businesses owned by minorities, women, and persons with physical or mental disabilities. For assistance in locating and identifying certified businesses, contact the Michigan Department of Civil Rights, Business and Community Affairs, Cadillac Place, 3054 W. Grand Boulevard, Suite 3-600, Detroit, MI 48202, 1-800-482-3604.

\*14.11. Unfair Labor Practice - Bidders who have been found in contempt of court by a Federal Court of Appeals on not less than three occasions involving different violations during the preceding seven (7) years for failure to correct an unfair labor practice prohibited by Section 8 of Chapter 372 of the National Labor Relations Act, 29 U.S.C. 158 are not eligible to be awarded the Contract. A register of employers in violation of this requirement is compiled by the Michigan Department of Energy, Labor and Economic Growth pursuant to 1980 PA 278, MCL 423.321 et seq. Further, the Bidder awarded the Contract shall not use any Subcontractors or Suppliers on the Work whose name appears on the register. According to Section 4 of 1980 PA 278, any contract entered into by the State may be declared void and rescinded to the extent the Bidder awarded the Contract or any Subcontractor, manufacturer, or Supplier awarded Work under the Contract subsequently appears in the register compiled by the Department of Consumer and Industry Services.

\*14.12. Nondiscrimination – The Bidder awarded the Contract, and each Subcontractor and Supplier awarded a Sub agreement covenants that it will comply with the nondiscrimination requirements described in paragraphs 7.12.1 through 7.12.3 of Section 00700 General Conditions.

\*14.12.1. A breach of the covenants set forth in paragraph 7.12 of Section 00700 General Conditions shall be regarded as a material breach of the Contract.

\*14.12.2. The Bidder awarded the Contract shall include or incorporate by reference paragraph 14.12.1 (above) and the provisions of paragraphs 7.12.1 through 7.12.3 of Section 00700 General Conditions in every Sub agreement, unless exempted by rules, regulations, or orders of the Michigan Civil Rights Commission. Each Sub agreement shall provide that those provisions shall be binding upon the Subcontractor or Supplier.

\*14.13. Bidders are further directed to Article 7 of Section 00700 General Conditions for terms and conditions concerning the following Michigan legal requirements applicable to this Contract: (a) Laws and permits, paragraph 7.1, (b) taxes, paragraph 7.2, (c) safety and protection, paragraph 7.3, (d) unfair labor practice, paragraph 7.10, (e) Michigan Right-to-Know Law, paragraph 7.11, and (f) Michigan residency for employees, paragraph 7.13.

## **ARTICLE 15 EXECUTION OF THE AGREEMENT**

15.1. Upon acceptance of a Bid for the Work by the **Board** or by the **Director** of the **Department** of Technology, Management and Budget, the **Director-DCD** or his/her designee will send the Notice of Award to the Bidder awarded the Contract. The Notice of Award will (a) designate the



Contract Price and itemize the Alternates that the **Owner**, in its sole discretion, has accepted, (b) enclose completed, unsigned Section 00500 Agreement forms and blank Section 00610 Performance and Section 00620 Payment Bond forms, and (c) outline the procedures to be followed and information to be provided by the **Contractor** for execution of Section 00500 Agreement.

15.2. Unless otherwise designated in the Notice of Award, within fifteen (15) Calendar Days after receipt of the Notice of Award, the Bidder recommended for award shall (a) sign Section 00500 Agreement; (b) execute Section 00610 Performance Bond and Section 00620 Payment Bond (and attach to each Bond separate, certified copy of Power of Attorney); and (c) return to the Owner the executed Section 00500 Agreement, Section 00610 Performance Bond and Section 00620 Payment Bond forms, evidence of original certificates of insurance and any other documents required for submission by the Notice of Award.

15.3. Evidence of insurance shall consist of certificates of insurance confirming that the policies of insurance that the **Contractor** has obtained, including the limits of coverage and endorsements provided, are in compliance with the insurance requirements specified in paragraphs 7.4 through 7.7 of Section 00700 General Conditions. Certificates of insurance shall contain a statement confirming that coverage will not be canceled, adversely changed or renewal refused until at least thirty (30) Calendar Days' prior written notice has been delivered or mailed to the **Owner** and **Contractor**.

15.4. The **Owner** will execute the Section 00500 Agreement retain one hard copy and compile a complete electronic copy of the Contract Documents upon two conditions: (a) receipt of the executed Section 00500 Agreement, Section 00610 Performance Bond and Section 00620 Payment Bond (with each Bond enclosing a separate certified copy of Power of Attorney and a separate certificate of principal) and evidence of insurance; and (b) a determination by the **Owner** that the Section 00610 Performance Bond and Section 00620 Payment Bond, required certifications and evidence of insurance received conform to the requirements of the Contract Documents and are acceptable to the **Owner**.

15.5. Each full set of the executed Contract Documents shall consist of: (a) two (2) or more volumes containing the executed Agreement (conformed Section 00500); executed Performance and Payment Bond and certifications (conformed Section 00610 and Section 00620); the **Contractor's** Bid Form and Non-Collusion Affidavit (conformed Sections 00300 and 00320); and the remainder of the Bidding Documents, including Addenda; and (b) a separate volume with Qualification Submittals submitted by the **Contractor** that the **Owner**, in its sole discretion, chooses to include as part of the Contract Documents. The **Contractor** will receive one full set of the executed Contract Documents.

15.6. Bid prices in the "Schedule of Change Order Prices" on the **Contractor's** Bid Form accepted by the **Owner** upon evaluation of the **Contractor's** Bid will be incorporated into the Contract as provided in paragraph 3.2 of Section 00500 Agreement.

15.7. The Notice to Proceed shall be authorized by the **Director-DCD** or his/her designee. Subject to the provisions of Article 13 and compliance with paragraphs 15.2 through 15.4, the Notice to Proceed shall designate a Date of Commencement of the Contract Time no later than sixty (60) Calendar Days after the date ending the Bid hold period, or thirty (30) Calendar Days after receipt by the **Owner** of the executed Section 00500 Agreement and acceptable, executed Section 00610 Performance Bond and Section 00620 Payment Bond, whichever last occurs, unless otherwise directed in writing by the **Owner**.

15.8. Within fifteen (15) Calendar Days after receiving the Notice to Proceed, the **Contractor** shall submit to the **Owner** any additional Change Order cost and pricing data requested with the Notice to Proceed. The **Contractor's** submittal shall be itemized in a breakdown acceptable to the **Owner**, and shall be certified as accurate, current, and complete by a duly authorized financial representative of the **Contractor**. The **Contractor** shall meet with the **Owner** to review the cost and pricing data submittal. The **Owner** shall incorporate into the Contract Documents any acceptable cost and pricing data by Change Authorization issued within a reasonable time after the Notice to Proceed.

#### ARTICLE 16 MOBILIZATION PAY ITEM

16.1. The mobilization pay item, if designated in the Specifications and/or the Bid Schedule in Section 00300 Bid Form, shall be intended to cover, at least in part, up-front costs incurred by the **Contractor** from Contract Award until sixty (60) Calendar Days after the **Contractor** starts the Work. Allowable mobilization items shall be as itemized in the Schedule of Values approved by the **Professional**, and may include costs incurred by the **Contractor** (a) in establishing temporary site offices and other facilities specified in the Specifications, (b) in obtaining permits required to commence the Work, (c) for premiums for the required Section 00610 Performance Bond and Section 00620 Payment Bond, (d) for insurance obtained by the **Contractor** to comply with the requirements of the Contract Documents, and (e) in complying with the Revision 0 Schedule and Cost Submittal requirements.

16.2. Total payments to the **Contractor** under the mobilization pay item shall not exceed four percent (4%) of the Base Bid, unless otherwise expressly provided in the Bidding Documents. If the **Contractor** incurs costs, which the **Contractor** considers within the scope of the mobilization pay item, more than the four percent (4%) limitation, those excess costs will not be reimbursed under the mobilization pay item and will be deemed to have been included in other parts of the **Contractor's** Bid.

16.3. To the extent practicable, the basis of measurement for payment shall be proof of actual payment by the **Contractor**. Where actual payment by the **Contractor** does not apply, as in the case of premiums for the Section 00610 Performance Bond, the Section 00620 Payment Bond and the insurance policies the **Contractor** is required to furnish under the provisions of Article 15, or in connection with the **Contractor** costs to comply with the Revision 0 Progress Schedule and Cost Submittal requirements of the Contract Documents, the basis of measurement for payment shall be

as stipulated in the Schedule of Values approved by the **Professional**. Payments to the **Contractor** shall be based on the requirements of the Bidding Documents, subject to the following:

16.3.1. Approval by the **Professional** of the Schedule of Values (required by paragraph 12.1 of Section 00700 General Conditions) shall be a condition precedent to making any payment under the mobilization pay item. Partial payments shall be based on the breakdown itemized in the Schedule of Values and the extent of completion, as determined by the **Professional**.

16.3.2. Full payment of the amount corresponding to the Revision 0 Schedule and Cost Submittals shall be paid by with the Request for Payment following return to the **Contractor** of the Revision 0 Submittal, or Revision 0A Submittal (i.e., first resubmission), Revision 0B Submittal (i.e., second resubmission), etc. of the Progress Schedule marked "Resubmittal Not Required."

#### **ARTICLE 17 SOIL EROSION AND SEDIMENTATION CONTROL —FINE FOR NON-COMPLIANCE**

17.1. All Work within this Contract must comply with the applicable soil erosion and sedimentation control rules and regulations (Soil Erosion and Sedimentation Control – 1994 PA 451, Part 91, as amended, MCL 324.9101 et seq.) and specific provisions for same within the Contract Documents. Soil erosion and sedimentation control will be monitored and enforced by the Department of Technology, Management and Budget, **State Facilities Administration**.

17.2. Soil erosion and sedimentation control on **Department** Projects will be monitored and enforced by **State**

**Facilities Administration** through the review of **Contractor** implementation plans and site inspections by Soil Erosion and Sedimentation Control Unit personnel and/or **State Facilities Administration** Representative.

17.2.1. In the event, the **Owner** determines through site inspections by the **State Facilities Administration** Representative or by notification by regulatory authorities that the **Contractor** has not met the soil erosion requirements of the Project and/or is in violation of the applicable soil erosion and sedimentation control statutes, the **Contractor** shall be notified in writing and stop work orders may be issued by **State Facilities Administration** in conjunction with paragraph 2.3 of Section 00700 General Conditions.

17.3. In the event, the **Owner** determines through site inspections by the **State Facilities Administration** Representative or by notification by regulatory authorities that the **Contractor** has not met the soil erosion requirements of the Project and/or is in violation of the applicable soil erosion and sedimentation control statutes, the **Contractor** shall be notified in writing and corrective actions undertaken by **State Facilities Administration** in conjunction with paragraph 9.4 of Section 00700 General Conditions.

17.4. In the event, the **Contractor** fails to respond to written notice from **State Facilities Administration** regarding noncompliance with the provisions of the Contract Documents and/or soil erosion and sedimentation control regulations applicable to this Work, **State Facilities Administration** has the right to assess a fine to the **Contractor**. Fines shall be in addition to any other remediation costs or liquidated damages applicable to the Project and may exceed the value of the Contract.

**END OF SECTION 00100**

**ATTACHMENT A TO SECTION 00100 – BIDDER'S CHECK LIST****PROFESSIONAL – WTA Architects**

WORK – Center for Forensic Psychiatry - Create Kitchen

AGENCY No. – 491

FILE No. – 491/20167.SDW

**BEFORE BID OPENING:**

10/4/2023 – Due date for delivery to the **Professional** of written proposals seeking to have the **Professional** consent to naming additional materials or equipment by Addenda. (Reference: Section 00100, Paragraph 7.2).

9/25/2023 – Bidder inquiries received after this date will not be answered, unless answered through Addenda issued at least seventy-two (72) hours before Bid opening (Business Days only), the Bid opening is postponed by Addendum, or the Work is rebid following post-Bid Addenda. (Reference: Section 00100, paragraph 4.1).

**CONTENTS SHALL BE UPLOADED AS A PDF DOCUMENT TO/THROUGH SIGMA VSS (ITEMS 1 THROUGH 5.3 BELOW):**

**NOTE 1: THE BIDDER SHALL USE THE BID SUMMARY, BID FORM AND BID FORM ATTACHMENTS INCLUDED WITH THE BIDDING DOCUMENTS, UNLESS REVISED BY ADDENDUM, IN WHICH CASE THE LATEST REVISION OF THE BID SUMMARY, BID FORM AND/OR BID FORM ATTACHMENTS ISSUED BY ADDENDUM SHALL BE USED.**

**NOTE 2: THE BIDDER IS NOT REQUIRED TO INCLUDE THE PROJECT MANUAL OR DRAWINGS IN THE PDF BID DOCUMENT PACKAGE UPLOADED TO SIGMA VSS, ONLY THE COMPLETED BID SUMMARY, BID FORM AND BID FORM ATTACHMENTS!**

- 1. Completed Bid Summary provided with Section 00300 Bid Form.
- 2. Completed Section 00300 Bid Form, which requires (a) completing the acknowledgment of Addenda in paragraph 2.1, (b) filling out Article 6 Bid Schedule and, if any prices are designated, completing Article 7 Change Order Prices, and (c) completing Article 8, that is, entering the date the Bid is submitted, completing paragraphs 8.1 through 8.4, and, if the Bidder is a joint venture, paragraph 8.5, and signing, as appropriate, in the spaces provided.
- 2.1 Completed Certificate of Principal or other equivalent acceptable certificate or authorization document, which certificate shall be attached to the completed Section 00300 Bid Form.
- 3. If the Bid includes a Bid Bond, ensure that the surety is authorized to do business in the State by the Department of Licensing and Regulatory Affairs – Insurance Bureau and is listed on the current U.S. Department of the Treasury Circular 570. Also, ensure that the completed Section 00310 Bid Bond is dated, is signed by both the Bidder and surety and attaches Power of Attorney. If the Bid includes a certified or cashier's check or money order, that check or money order shall be delivered in original copy before the Bid Due Time to:

State Facilities Administration  
Design & Construction Division  
3111 W. St. Joseph Street  
Lansing, Michigan 48917

*All other Bid information must be submitted via SIGMA as per standard bidding procedure*

- 4. Completed Section 00320 Noncollusion Affidavit.
- 5. Qualified Disabled Veterans Preference Documentation (if preference requested).
- 5.1 DD 214 – Proof of Service/Discharge.
- 5.2 Veterans Administration Rating Decision Letter – Proof of Disability, if not indicated in the DD 214.
- 5.3 Legal Proof of 51% QDV Ownership

This Bidder's Check List is provided solely to aid the Bidder in submitting a Bid. It shall not be relied on to include all items necessary to insure a complete Bid. The Bidder is solely responsible for including all items as required by the Bidding Documents, including any items required by Addenda, which may not be listed in this Bidder's Check List.

**END OF ATTACHMENT A TO SECTION 00100**

**SECTION 00120 – SUPPLEMENTARY INSTRUCTIONS**

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**PROFESSIONAL** – WTA Architects  
WORK – Center for Forensic Psychiatry - Create Kitchen  
FILE No. – 491/20167.SDW

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The provisions of this Section 00120 Supplementary Instructions amend or supplement Section 00100 Instructions to Bidders and those other provisions of the Bidding Requirements that are indicated below. All other Bidding Requirements that are not so amended or supplemented remain in full force and effect.

Click or tap here to enter text.

**END OF SECTION 00120**

**SECTION 00210 – INFORMATION FOR BIDDERS**

**PROFESSIONAL** – WTA Architects  
**WORK** – Center for Forensic Psychiatry - Create Kitchen  
**FILE No.** – 491/20167.SDW

**1.0 RELATED PROVISIONS**

1.1. Paragraphs 3.4 through 3.7 of Section 00100 Instructions to Bidders, which contain terms and conditions governing the information made available to Bidders in this Section, are made part of this Section 00210 Information for Bidders by this reference.

**2.0 SUBSURFACE CONDITIONS**

2.1. The reports of explorations and tests of subsurface conditions itemized immediately below have been used by the **Professional** in the preparation of the Bidding Documents.

**\*\*\*If those reports are listed the Professional shall include a PDF copy with the SIGMA posting or otherwise make available for contractors to download \*\*\***

2.1.1. Information or data contained in those reports that may be properly considered Authorized Technical Data concerning subsurface conditions include (NOTE: All other information or data excluded from the list below represent Non-Technical Information or Data, interpretations, or opinions):

[Click or tap here to enter text.](#)

2.2. The reports of explorations and tests of subsurface conditions itemized immediately below have not been used by the **Professional** in the preparation of the Bidding Documents. Those reports are available at the office of the **Professional** for review or purchase. Neither the **Owner** nor **Professional** warrants that this list identifies all existing relevant documents.

**3.0 OTHER PHYSICAL CONDITIONS**

3.1. The Drawings and technical Specifications and those drawings itemized immediately below contain information or data that have been used by the **Professional** in the preparation of the Bidding Documents, and that may be properly considered Authorized Technical Data concerning physical conditions of existing surface and subsurface facilities.

[Click or tap here to enter text.](#)

3.2. The reference documents itemized immediately below have not been used by the **Professional** in the preparation of the Bidding Documents and are available at the office of the **Professional** for review or purchase. Information and data contained in those reference documents, including, but not limited to dimensions, locations and conditions of existing surface and subsurface structures, roadways, piping, raceways, equipment, etc. may not accurately or reliably reflect actual conditions. Neither the **Owner** nor **Professional** warrants that this list identifies all existing relevant documents.

[Click or tap here to enter text.](#)

**4.0 UNDERGROUND UTILITIES**

4.1. Information or data about physical conditions of existing Underground Utilities, that have been used by the **Professional** in the preparation of the Bidding Documents, is shown or indicated in the Drawings and technical Specifications and those Underground Utility drawings itemized immediately below.

[Click or tap here to enter text.](#)

**5.0 PERMITS, APPROVALS, LICENSES AND FEES**

5.1. To the extent that the **Owner** has secured or will secure any permits, approvals and licenses and has paid or will pay any associated charges and fees, any such permits, approvals and licenses are itemized in this paragraph.

[Click or tap here to enter text.](#)

5.2. In the event any permits, approvals and licenses itemized in paragraph 5.1 have been obtained by the **Owner** and the fees have been paid, copies of those permits, approvals, licenses, and corresponding fee receipts, **will be attached by the Professional as a PDF copy with the SIGMA posting or will otherwise be made available for contractor to download.**

5.3. Except for any permits, approvals, licenses, and fees identified in paragraph 5.1, the **Contractor** shall be responsible for all permits, approvals, licenses, and fees applicable to Work.

**6.0 SEQUENCING REQUIREMENTS**

6.1. Refer to the technical Specifications, including, but not limited to the General Requirements, for information, data, and criteria on sequences of Work restraints, constructability, and maintenance of service to existing facilities, which, if provided, shall govern the selection of Work sequences.

6.2. Each Bidder shall be responsible for any conclusions or interpretations the Bidder makes related to the selection of sequences and Means and Methods, based on the technical data made available, and/or those additional investigations or studies made or obtained by that Bidder.

**END OF SECTION 00210**

**SECTION 00300 – BID SUMMARY**

DTMB-0401M (R 03/21)

**BID SUMMARY**  
**DEPARTMENT OF TECHNOLOGY, MANAGEMENT AND BUDGET**

STATE FACILITIES ADMINISTRATION  
 DESIGN AND CONSTRUCTION DIVISION  
 3111 W. St. Joseph Street  
 Lansing, Michigan 48917

**Bids must be submitted electronically through the SIGMA VSS website at**  
<https://sigma.michigan.gov/webapp/PRDVSS2X1/AltSelfService>

FILE NUMBER <b>491/20167.SDW</b>	FUNDING CODE <b>171CODHHS7255</b>	DEPARTMENT/AGENCY <b>Department of Health &amp; Human Services (MDHHS)</b>	
CONTRACT TIME(S) *** (duration or deadline)	PROJECT NAME <b>Center for Forensic Psychiatry, Create Kitchen</b>		LOCATION <b>Saline, Michigan</b>
BID OPENING DATE  <b>October 4<sup>th</sup>, 2023 at 2:00 pm Local Time</b>		FOR AN EXAMINATION OF THE SITE CONTACT: <b>Day of walk-through only</b>	
SEE SECTION 00100 INSTRUCTIONS TO BIDDERS AND SECTION 00700 GENERAL CONDITIONS PROVIDED WITH THE BIDDING DOCUMENTS. <b>BID: WE PROPOSE TO FURNISH, PERFORM AND COMPLETE THE ENTIRE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS IN CONSIDERATION OF THE BID PRICE (S) STATED BELOW.</b>			
FIRM NAME AND COMPLETE ADDRESS		TELEPHONE NUMBER and E-MAIL ADDRESS	
<input type="checkbox"/> Qualified Disabled Veteran BIDDER'S SIGNATURE AND TITLE		<b>SIGMA VENDOR NUMBER</b>	
		<small>(protected information required for processing payments)</small>	
DATE	WITNESS' SIGNATURE	DATE	DATE

By signing this bid above, bidder certifies their enclosed Qualified Disabled Veteran and Michigan-Based Business Certifications.

**BASE BID FROM BID SCHEDULE** (Include specified Allowances):

\_\_\_\_\_ Dollars \$ \_\_\_\_\_  
(use words) (in figures)

**Allowance No. 1: Provisionary Allowance - \$00,000.00 (to be included in Base Bid)**

Alternate1: (Add/Subtract) \_\_\_\_\_ Dollars \$ \_\_\_\_\_  
(use words) (in figures)

**Builders Risk Insurance is NOT provided by the State of Michigan. (See Section 00700, Paragraph 7.7.)**

A PERFORMANCE BOND AND A PAYMENT BOND ARE REQUIRED FOR ALL BIDS OVER \$50,000.00. EACH BID MUST BE ACCOMPANIED BY A FIVE (5) PERCENT BID GUARANTEE.

BIDDERS ARE ALSO CAUTIONED TO FAMILIARIZE THEMSELVES WITH ALL OF THE OTHER CONDITIONS OF THE CONTRACT.

Project Scope of Work:

**New one-story with a penthouse addition to existing structure for commercial kitchen and dining space. Addition totals 11,124 square feet and includes plumbing, HVAC, electrical, food service equipment, communications and IT, and associated site work for new construction.**

The Bidder must figure its Base Bid on the specified, or Addendum-approved, materials and equipment **only**. No "or equal" or substitution proposals will be permitted after Bid opening, except as provided in the General Conditions.

Addenda: Bidder acknowledges receipt of Addenda: No. \_\_\_ dated: \_\_\_\_\_, No. \_\_\_ dated: \_\_\_\_\_ No. \_\_\_ dated: \_\_\_\_\_

**SECTION 00300 BID FORM**

WORK – Center for Forensic Psychiatry - Create Kitchen

AGENCY No. – 491 FUNDING CODE. 171CODHHS7255 FILE No. 491/20167.SDW

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**ARTICLE 1 THIS BID IS SUBMITTED TO THE STATE OF MICHIGAN ("the Owner").**

1.1. The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an agreement with the **Owner** on the form in Section 00500 Agreement and to furnish and perform the Work as specified or indicated in the Bidding Documents for the Bid prices in the "Bid Schedule" on this Section 00300 Bid Form, within the Contract Times specified in Section 00500 Agreement, and in accordance with all other provisions and terms and conditions of the Bidding Documents, including, without limitation, those dealing with the disposition of the Bid Security.

1.2. The undersigned Bidder agrees to hold this Bid open for acceptance by the **Owner** for the period specified in Article 9 of Section 00030 Advertisement.

**STATE OF MICHIGAN MODEL**  
Developed from FORMSPEC™ Michigan Model

**1.3. The Bidder will provide a signed original of Section 00500 Agreement, the executed Section 00610 Performance Bond, the executed Section 00620 Payment Bond, and appropriate evidence of insurance within the times and in the manner specified in the Bidding Documents.**

**ARTICLE 2 THE BIDDER'S REPRESENTATIONS**

**2.1. The Bidder has examined the Bidding Documents, including the Addenda acknowledged in the table below. The**

**Bidder has verified that the Addenda acknowledged below include all issued Addenda. Except for Addenda, which solely revise the date of Bid, opening, failure by the Bidder to acknowledge receipt of all Addenda correctly, by either failing to complete or incorrectly completing the table below, shall justify the Owner's refusal to read the Bid and automatically disqualify the Bidder from any consideration for award of the Contract.**

No. ___ Dated _____	No. ___ Dated _____
No. ___ Dated _____	No. ___ Dated _____
No. ___ Dated _____	No. ___ Dated _____

2.2. The Bidder has taken those steps that are reasonably necessary to (a) ascertain and become familiar with the Work, site, and locality; (b) account for all applicable federal, state, and other local Laws and all general, local, and prevailing conditions that may in any manner affect cost, schedule, progress, performance or furnishing of the Work; and (c) study and account for the terms and conditions of the Bidding Documents. The Bidder has carefully correlated the Bidder's observations with the Bidding Documents.

2.3. The Bidder has studied carefully all reports concerning subsurface conditions and drawings of physical conditions of existing surface and subsurface facilities that have been used by the **Professional** and all documents of physical conditions of existing Underground Utilities facilities that have been used by the **Professional** – in both cases as identified in Section 00210 Information for bidders. The Bidder assumes responsibility for carefully and accurately locating existing Underground Utilities in a manner consistent with paragraph 10.3 of Section 00700 General Conditions and as required by 1974 PA 53, as amended, MCL 460.701 et seq. The Bidder accepts the determinations set forth in the Bidding Documents as to the extent of such Authorized Technical Data and Underground Utilities information and data contained in those reports, drawings, documents, or the Bidding Documents, as applicable, upon which the Bidder may rely.

2.4. To the extent Additional Technical Data has been considered by the Bidder as necessary for determining the Bid in Article 6 Bid Schedule, and the **Owner**, upon request, did not have the necessary Additional Technical Data, the Bidder assumes responsibility for having undertaken or undertaking reasonable examinations of the site and any other pertinent available information and data. The Bidder agrees to perform and furnish the Work affected by the conditions involved, at no increase in Contract Price and Contract Time, to the extent the information and data

necessary for determining the Bid could have been discovered through reasonable examinations of the site and any other pertinent information and data available (including, but not limited to the information and data designated in Section 00210 Information for Bidders).

2.5. The Bidder has carefully correlated the results of its observations, examinations, and studies of those reports of explorations and all that information and data in studies, drawings, and specifications, referred to in paragraphs 2.3 and 2.4, with the terms and conditions of the Bidding Documents.

2.6. The Bidder has examined all information and data shown or indicated in the Bidding Documents concerning other work, including, but not limited to provisions in Section 00700 General Conditions. The Bidder assumes responsibility for all reasonably foreseeable terms, conditions and consequences resulting from other work that may in any manner affect cost, schedule, progress, performance or furnishing of the Work.

2.7. The Bidder has carefully examined the terms and conditions of the Bidding Documents concerning Delay, Activity Float times and early completion. The Bidder agrees that increases in Contract Price and/or Contract Time for Delay shall be as provided in Section 00700 General Conditions. The Bidder has correlated those terms and conditions with the Bidder's schedule for the Work and its Base Bid and Alternates.

2.8. The Bidder represents that each unit price covering Specified or Contingent Unit Price Work, whether bid on Article 6 – Bid Schedule or on Article 7 – Schedule of Change Order Prices, includes sufficient amounts to cover (a) all labor costs, Subcontractor costs, material and equipment costs, construction equipment costs and general conditions costs, and (b) all administrative costs and home office overhead, and (c) profit. The **Owner** reserves the right to reject any unit prices bid on paragraph 6.2 Schedule of Alternates or in Article 7 Schedule of Change Order Prices, which, in the **Owner's** sole discretion, are not in the **Owner's** best interest.

2.9. The Bidder has given the **Professional** written notice of all conflicts, ambiguities, errors, or omissions the Bidder has discovered in the Bidding Documents, and the written resolution given by the **Professional** is acceptable to the Bidder.

2.10. This Bid is genuine, is not made in the interest of or on behalf of any undisclosed person and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation. To induce the **Owner** into consideration of this Bid, the Bidder reiterates and makes each of the representations made by the Bidder in Section 00320 Non-collusion Affidavit attached to this Section 00300 Bid Form.

2.11. The Bidder is aware of the **Owner's** requirements for business owned by minorities, women, and persons with physical or mental disabilities, and assumes responsibility for all conditions and consequences that may result from meeting those requirements and that may in any manner affect cost, schedule, progress, performance and furnishing of the Work.

2.12. The Bidder has read and studied each provision of the Bidding Documents. The Bidder has no expectations different from the terms and conditions of the Bidding Documents.

### **ARTICLE 3 TIME OF COMPLETION**

3.1. The Contract Times are specified in paragraph 4.1 of Section 00500 Agreement. The Bidder has carefully correlated the provisions in paragraph 4.1 of Section 00500 Agreement with the other terms and conditions of the Bidding Documents and unequivocally accepts the Contract Times for the Work, and any other designated parts of the Work, as specified.

3.2. The Bidder unequivocally accepts the liquidated damage provisions specified in paragraph 4.2 of Section 00500 Agreement in the event of any failure, neglect, or refusal to complete the Work, or designated part of the Work, within the corresponding Contract Times specified in paragraph 4.1 of Section 00500 Agreement.

### **ARTICLE 4 ATTACHMENTS INCLUDED WITH THIS BID**

4.1. Attachments to this Section 00300 Bid Form and made a condition of this Bid are:

4.1.1. Evidence of Authority to Sign the Bid.

4.1.2. Section 00310 Bid Bond, with the attached certified copy of Power of Attorney, or

Alternate Bid Security.

4.1.3. Section 00320 Non-collusion Affidavit.

#### **TO BE PROVIDED POST BID WITH SECTION 00400 SUBMITTALS:**

4.1.5 Current EMR Rating

4.1.6 Identification of the proposed project superintendent with a resume or list of similar projects handled by that individual.

4.1.7 A list of at least three (3) projects completed within the last three (3) years of similar size and complexity, with contact information for references for each.

4.2. Bidder-provided documents, made a condition of this Bid, are as required in the following Section(s) of the Bidding Documents:

### **ARTICLE 5 DEFINED TERMS**

5.1. Section 00020 Glossary assigns specific intent and meanings to capitalized terms and to other defined terms used in (a) this Section 00300 Bid Form, (b) Section 00310 Bid Bond and Section 00320 Non-collusion Affidavit, and (c) Section 00410 Bid Breakdown, Section 00420 Questionnaire, Section 00430 List of Subcontractors and Section 00440 Schedule of Materials and Equipment.



**ARTICLE 6 BID SCHEDULE**

**6.1 Base Bid Schedule** - The Bidder will complete the Work and accept in full payment, for the Work items listed, the following unit prices and/or Bid Prices, as applicable:

Base Bid Item No.	Bid Quantity	Description	Unit Price	Item Bid Price
1	Lump Sum	Combined Total All Work		
		<b>ALLOWANCE AMOUNT - Provisionary Allowance</b>		<b>\$ 00,000.00</b>
<b>TOTAL (This amount should equal the Base Bid amount on the Bid Summary Form)</b>				<b>\$</b>

**Base Bid** (Sum of Bid Prices for all Base Bid Items):

\_\_\_\_\_ Dollars and No/Cents \$ \_\_\_\_\_ (use words) (in figures)

Name of the Bidder \_\_\_\_\_ Agency No. \_\_\_\_\_ Funding Code \_\_\_\_\_ File No. \_\_\_\_\_

Date \_\_\_\_\_

**SIGMA VENDOR NUMBER** \_\_\_\_\_

Telephone No. \_\_\_\_\_

6.2 Schedule of Alternates - The Bidder will complete (or deduct from the Contract) the parts of the Work designated by the Alternates that follow and accept in full payment (or allow in full credit) for those parts of the Work the following Bid Prices:

Alternate Item No.	Bid Quantity	Description	Unit Price	Item Bid Price

The Bidder further acknowledges and agrees that the separate prices bid on this "Schedule of Alternates," where they are applicable and deemed acceptable by the Owner, will be used if incorporated into the Contract when the Owner issues the Notice of Award.

Name of the Bidder \_\_\_\_\_ Agency No. \_\_\_\_\_ Funding Code \_\_\_\_\_ File No. \_\_\_\_\_

Date \_\_\_\_\_

SIGMA VENDOR NUMBER \_\_\_\_\_

Telephone No. \_\_\_\_\_

**ARTICLE 7 SCHEDULE OF CHANGE ORDER PRICES**

7.1 The Bidder shall use this "Schedule of Change Order Prices" to propose contingent prices. The proposed contingent Change Order prices set forth in this schedule, at the sole discretion of the **Owner**, may, or may not be incorporated into the Contract Documents. The **Owner** reserves the right to negotiate contingent Change Order prices set forth herein prior to their possible incorporation into the Contract Documents. Proposed Change Order prices will not affect determination of the lowest Bid.

7.2 Subject to their incorporation into the Contract Documents, as provided in the Agreement, the Bidder will add to, or deduct from, the Contract Work covered by the contingent prices that follow and accept in full payment, or allow in full credit, for that Work (a) those prices bid by the Bidder, or (b) if a particular price is not bid, the price proposed by the **Owner** (and shown in the appropriate column):

Item No.	Bid Quantity	Description	Unit Price	Item Bid Price

Name of the Bidder \_\_\_\_\_ Agency No. \_\_\_\_\_

Funding Code \_\_\_\_\_ File No. \_\_\_\_\_

Date \_\_\_\_\_

**SIGMA VENDOR NUMBER** \_\_\_\_\_

Telephone No. \_\_\_\_\_

ARTICLE 8 BID SUBMITTED ON the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

8.1. Bid Security is in the form of a Bid Bond \_\_\_\_\_ Bid Bond form provided in Section 00310 has been duly executed \_\_\_\_\_; or
A Certified or Cashier's check \_\_\_ or Money Order \_\_\_ if a check or money order is provided as Bid Security, the original check/money order must be delivered before Bid Due Time to the issuing office as per Section 00100 paragraph 5.2 and Section 00110 item 3.

8.2. If the Bidder is an Individual:

Name of Individual: \_\_\_\_\_
Name & Title of Person Authorized to sign: \_\_\_\_\_
Signature: \_\_\_\_\_ (If not the Individual, Attach Power of Attorney) Date \_\_\_\_\_
Doing Business as: \_\_\_\_\_
Business Address: \_\_\_\_\_
SIGMA VENDOR NUMBER \_\_\_\_\_
County of registration \_\_\_\_\_
Telephone: \_\_\_\_\_ FAX: \_\_\_\_\_

8.3. If the Bidder is a Partnership:

By: \_\_\_\_\_ (True Name of the Partnership)
Partner Authorized to Sign \_\_\_\_\_ Date \_\_\_\_\_
Signature: \_\_\_\_\_ (Attach evidence of Authority to sign) Date \_\_\_\_\_
Business Address: \_\_\_\_\_
SIGMA VENDOR NUMBER \_\_\_\_\_
County of registration \_\_\_\_\_
Telephone: \_\_\_\_\_ FAX \_\_\_\_\_

8.4. If the Bidder is a Corporation:

By: \_\_\_\_\_ (Legal Corporation Name)
Name & Title of Authorized Officer: \_\_\_\_\_
Signature: \_\_\_\_\_ (Attach evidence of Authority to sign) Date \_\_\_\_\_
Name & Title of Officer Attesting: \_\_\_\_\_
Signature: \_\_\_\_\_ Date \_\_\_\_\_
Business Address: \_\_\_\_\_
SIGMA VENDOR NUMBER \_\_\_\_\_
Telephone: \_\_\_\_\_ FAX \_\_\_\_\_
(State of Incorporation): \_\_\_\_\_

8.5. If The Bidder is A Joint Venture: JOINT VENTURE SIGNATURES SHALL BE AS PROVIDED IN PARAGRAPH 9.5 OF SECTION 00100 INSTRUCTIONS TO BIDDERS. EACH JOINT VENTURER SIGNING THE BID SHALL SIGN IN THE MANNER INDICATED FOR AN INDIVIDUAL, A PARTNERSHIP OR A CORPORATION. IF MORE THAN TWO JOINT VENTURERS OF THE SAME TYPE ARE INCLUDED, USE ADDITIONAL PAGES. JOINT VENTURE STATE OF INCORPORATION \_\_\_\_\_ OR COUNTY OF REGISTRATION \_\_\_\_\_

CERTIFICATE OF PRINCIPAL

(BIDDER)

I, \_\_\_\_\_, certify that I am the Secretary of the Corporation \_\_\_\_\_, or a General Partner \_\_\_\_\_ or Managing Partner \_\_\_\_\_ or Partner \_\_\_\_\_ of the partnership, named as the Bidder in the attached Section 00300 Bid Form; that \_\_\_\_\_ who signed Section 00300 Bid Form on behalf of the Bidder, was then \_\_\_\_\_ of that corporation \_\_\_\_\_ or partnership \_\_\_\_\_; that I know the undersigned's signature, and the signature is genuine; and that Section 00300 Bid Form was duly signed, sealed and attested for and on behalf of that corporation \_\_\_ partnership \_\_\_ by authority of its governing body \_\_\_ or partners \_\_\_\_\_

\_\_\_\_\_  
Signed by the Secretary or Other Authorized Officer of the Corporation \_\_\_\_\_ Date \_\_\_\_\_  
or By General Partner or Managing Partner or Authorized Partner Certifying

\_\_\_\_\_  
Name of the Corporation or True Name of the Partnership

\_\_\_\_\_  
Federal Identification (I.D.) No. or Social Security No. (LAST 4 ONLY)

\_\_\_\_\_  
Telephone No.

(Corporate Seal)

VERIFICATION  
(BIDDER)

STATE OF MICHIGAN )  
 )  
COUNTY OF \_\_\_\_\_ )

Before me, a Notary duly commissioned, qualified and acting, personally appeared (enter name of person who signed the Bid Form on behalf of the Bidder), \_\_\_\_\_ to me well known to be the person described in and who signed Section 00300 Bid Form, who being by me first duly sworn upon oath, says that he/she is the Attorney-in-Fact for (enter the Bidder's name) \_\_\_\_\_ and that he/she has been authorized by (enter name of individual, partnership name, or that governing body of the Bidder named in the attached corporate resolution) \_\_\_\_\_ to execute the attached Section 00300 Bid Form on behalf of the named Bidder in favor of the STATE OF MICHIGAN.

Subscribed and sworn before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

\_\_\_\_\_  
Notary Public, State of: \_\_\_\_\_

My Commission Expires: \_\_\_\_\_

END OF SECTION 00300

SECTION 00310 BID BOND

AGENCY No. 491 Funding Code: 171CODHHS7255

FILE No. 491/20167.SDW SURETY COMPANY REFERENCE No.

KNOW ALL PERSONS BY THESE PRESENTS: That we, "the Bidder," \_\_\_\_\_, a corporation \_\_\_\_\_, individual \_\_\_\_\_, partnership \_\_\_\_\_, joint venture \_\_\_\_\_, of the State of \_\_\_\_\_, qualified to do business in the State of Michigan, as Principal, and "the Surety," \_\_\_\_\_, of the State of \_\_\_\_\_, as surety, are hereby held and firmly bound unto the State of Michigan, "the Owner," as Obligee, in the amount of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_), and if no amount is entered, in the amount of five percent (5%) of the Bidder's Base Bid designated in paragraph 6.1 Base Bid Schedule in Section 00300 Bid Form, for the payment of which the Bidder and the Surety hereby bind ourselves, our respective heirs, successors, legal representatives and assigns, jointly and severally, firmly by these presents in accordance with Michigan Law.

WHEREAS, the Bidder has submitted to the Owner a Bid, to which this Bond is attached, to enter into the Contract with the Owner for \_\_\_\_\_ covered by Bidding Documents prepared by the Professional, which Bidding Documents are incorporated into this Bid Bond by this reference:

NOW, THEREFORE: THE CONDITION OF THIS OBLIGATION IS THAT, if the Bidder faithfully performs and fulfills all the understandings, covenants, terms and conditions of the Bidding Documents governing the bidding and award of the Contract (including Addenda issued before Bid opening and any post-Bid Addenda) within the time specified or any extension thereof, with or without notice to the Surety or fails to do so but pays to the Owner the full amount of the sum set forth in this Section 00310 Bid Bond as liquidated damages - then THIS OBLIGATION SHALL BE NULL AND VOID, OTHERWISE THIS OBLIGATION SHALL REMAIN IN FULL FORCE AND EFFECT.

but not be limited to reasonable fees and charges of architects, engineers, attorneys and others, court or hearing costs incurred with or without suit, and interest.

A. If the Owner makes demand on the Surety to perform in accordance with the Surety's obligations under this Section 00310 Bid Bond, the full amount of the sum set forth in this Section 00310 Bid Bond shall be immediately due and payable to the Owner, and the Surety shall pay that sum without delay. Additionally, the Surety shall reimburse the Owner all costs of collection, which shall include,

B. The Surety, for value received, stipulates and agrees that the obligations of the Surety and this Section 00310 Bid Bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept the Bid, and the Surety does, by this agreement, waive notice of any such extension.

C. It is the intention of the Bidder, Surety and Owner that the Surety shall be bound by all terms and conditions of the Bidding Documents and this Section 00310 Bid Bond. However, if any provision(s) of this Section 00310 Bid Bond is/are illegal, invalid or unenforceable, all other provisions of this Section 00310 Bid Bond shall nevertheless remain in full force and effect, and the Owner shall be protected to the full extent provided by Michigan Law.

IMPORTANT: The Surety shall be authorized to do business in the State by the Department of Consumer and Industry Services – Insurance Bureau and listed on the current U.S. Department of the Treasury Circular 570, and shall be otherwise acceptable to the Owner.

Address and Telephone of Surety

Address and Telephone of Agent

Signed and sealed this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_ (NOTE: Use the date entered on Article 8 of Section 00300 Bid Form).

THE BIDDER: (Print Full Name and Sign)

THE SURETY: (Print Full Name and Sign)

By: \_\_\_\_\_

By Agent: \_\_\_\_\_

Name & Title: \_\_\_\_\_

By Attorney-in-Fact: \_\_\_\_\_ (Attach Certified Copy of Power of Attorney)

Signature: \_\_\_\_\_

Signature: \_\_\_\_\_

WITNESS: \_\_\_\_\_

WITNESS: \_\_\_\_\_

Telephone No. \_\_\_\_\_

Telephone No. \_\_\_\_\_

END OF SECTION 00310

SECTION 00320 NONCOLLUSION AFFIDAVIT

PROFESSIONAL – WTA Architects

WORK – Center for Forensic Psychiatry - Create Kitchen

AGENCY No. – 491 FUNDING CODE. 171CODHHS7255 FILE No. 491/20167.SDW

Affiant, \_\_\_\_\_, being first duly sworn, deposes and says that:

(1) Affiant is (enter title) \_\_\_\_\_ of \_\_\_\_\_, "the Bidder." Affiant has personal knowledge of the matters set forth in this Affidavit and is competent to testify about them.

(2) The Bidder has submitted to the Owner a "Bid" to enter into the above referenced Contract, also referred to in this Affidavit as "the Work."

(3) This Section 00320 Non-collusion Affidavit is executed by Affiant for inclusion with the submission to the Owner of the Bid and may be relied upon by the Owner in considering the Bid.

(4) Affiant is fully informed about the preparation and contents of the Bid and of all pertinent circumstances surrounding the Bid, has not entered into any contract, combination, conspiracy, or other act prohibited by federal, State or any other local Law. The Bid is genuine and is not a collusive or sham Bid.

(5) Neither the Bidder nor any of the Bidder's owners, officers, partners, directors, agents, representatives, employees or parties in interest, including this Affiant, have in any way entered or proposed to enter into any combination to prevent the making of any Bid, or to fix any prices (including overhead, profit or other costs) for the Bid; or have made any agreement, or given or promised any

By: \_\_\_\_\_

consideration to induce any other person not to Bid for the Work, or to Bid at a specified price; or have secured, proposed or intended to secure through any agreement an unlawful advantage against the Owner or any other person interested in the Work.

(6) No officer or employee of the State of Michigan is personally or financially interested, directly or indirectly, in the Bid, or any Contract which may be under it, or in the purchase or sale of any materials, equipment or supplies for the Work to which it relates, or any portion of any expected profits thereto.

(7) The Bid is not intended to secure an unfair advantage or benefit from the Owner or in favor of any person interested in the proposed Contract.

(8) The prices bid are fair and proper and are not tainted by any collusion, conspiracy, connivance, or unlawful agreement on the part of the Bidder or any other of the Bidder's owners, officers, partners, directors, agents, representatives, employees or parties in interest, including this Affiant; and neither the Bidder nor any of its owners, officers, partners, directors, agents, representatives, employees or parties in interest, including this Affiant, have divulged any information regarding the Bid or any data about the Bid to any other person.

Title: \_\_\_\_\_

SIGMA VENDOR NUMBER \_\_\_\_\_

Telephone No. \_\_\_\_\_

VERIFICATION

STATE OF \_\_\_\_\_ )
COUNTY OF \_\_\_\_\_ )

Before me, a Notary Public commissioned, qualified and acting, personally appeared (enter name of the person signing this Affidavit) \_\_\_\_\_ to me well known to be the person described in and who signed this Section 00320 Non-collusion Affidavit, who being by me first duly sworn upon oath, says that he/she is the Attorney-in-Fact for (enter Bidder's name) \_\_\_\_\_, that he/she has been authorized by (enter name of individual, partnership name, or the authorized governing body of the Bidder) \_\_\_\_\_ to execute this Section 00320 Non-collusion Affidavit on behalf of the named Bidder in favor of the STATE OF MICHIGAN, for the uses and purposes mentioned.

Subscribed and sworn to before me this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

Notary Public, State of \_\_\_\_\_
My Commission expires: \_\_\_\_\_, 20 \_\_\_\_

END OF SECTION 00320

**SECTION 00410 BID BREAKDOWN**

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**PROFESSIONAL** – WTA Architects

WORK – Center for Forensic Psychiatry - Create Kitchen

AGENCY No. – 491 FUNDING CODE. 171CODHHS7255 FILE No. 491/20167.SDW

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**1.0 BID BREAKDOWN:** The Apparent Low Bidder shall itemize below a cost breakdown of the Apparent Low Bidder's Bid. The Bid Breakdown shall be organized into separable parts of the Work so that one hundred percent (100%) of the Base Bid plus all Alternates is accounted for. Portions of the Work for which costs are itemized shall include Work to be furnished and performed directly by the Apparent Low Bidder and its Subcontractors and Suppliers, as applicable. Each separable part of the Work identified in this Bid Breakdown shall have a value not exceeding \_\_\_\_\_ percent (\_\_\_\_%) of the Apparent Low Bidder's Base Bid, except parts of the Work designating furnished materials or equipment, which may be itemized as quoted.

**2.0 DISCREPANCIES:** Discrepancies in this Section 00410 Bid Breakdown shall be resolved in accordance with Article 14 of the Instructions to Bidders. Any discrepancies between the Apparent Low Bidder's Bid Breakdown and Article 6 "Bid Schedule" on the Apparent Low Bidder's Section 00300 Bid Form with respect to a given lump sum item, unit price item or "One Each" item, or any sum of any of them, will be resolved so that the corresponding amount(s) on the Apparent Low Bidder's Section 00300 Bid Form will be binding on the Apparent Low Bidder.

**END OF SECTION 00410**



**PROFESSIONAL – WTA Architects**

WORK – Center for Forensic Psychiatry - Create Kitchen

AGENCY No. – 491 FUNDING CODE. 171CODHHS7255 FILE No. 491/20167.SDW

**ARTICLE 1 ORGANIZATION**

1.1. Date of organization (or incorporation) \_\_\_\_\_ State of incorporation \_\_\_\_\_ (IRS) EIN \_\_\_\_\_

1.2. Title and name of Principals (President, Vice-Presidents, Secretary and Treasurer, if a corporation; partners, if a partnership)

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1.3. Is your organization's principal place of business maintained in the State of Michigan? \_\_\_\_ If your organization maintains its principal place of business outside the State, attach a copy of the Certificate of Authority which your organization procured in accordance with MCL 450.2011.

1.4. If your organization, any business entity related to or affiliated with your organization, or any present or former executive employee, officer, director, shareholder (owning twenty percent (20%) or more of the outstanding shares), partner, or owner of your organization or of any such related or affiliated entity has ever been convicted of a felony, or has felony charges pending, in any state within the last three (3) years from the date of Bid opening, furnish with this Bidder's Questionnaire all material facts relating to any such felony conviction or such pending felony charges.

**ARTICLE 2 SPECIALTY CONTRACTOR LICENSES**

2.1. Does your organization hold valid licenses covering specialty classifications of Work that your organization itself intends to perform and for which a specific specialty license is required by any Political Subdivision with jurisdiction over the Work \_\_\_\_\_? If so, attach a list with all licenses by number and classification; state the name of the organization holding the license, the renewal date of each license, whether each license is active, and attach a copy of each license.

**ARTICLE 3 EXPERIENCE**

3.1. What is the general character of the work performed by your organization? \_\_\_\_\_ How many years of experience in construction work similar in character and scope to the Work under the Bidding Documents has your organization had: (a) as a General Contractor? \_\_\_\_\_; (b) as a Subcontractor? \_\_\_\_\_.

3.2. Attach a list of all public contracts or subcontracts under public contracts that your organization has performed within the last five (5) years which are similar in character and scope to the Work under the Bidding Documents (using the forms in the "References Attachment" provided with this Questionnaire). If the contract or subcontract referenced is not substantially completed, furnish the percent complete for that contract or subcontract.

3.3. Within the last five (5) years, has your organization been in litigation with The State of Michigan or failed to complete a contract or subcontract awarded to it? \_\_\_\_ If so, attach a list for each contract or subcontract, state when, where and why.

3.4. Within the last five (5) years, has any officer, partner or executive employee of your organization been an officer, partner or employee of another organization that was involved in a litigation with The State of Michigan? or failed to complete a contract or subcontract? \_\_\_\_\_. If so, for each contract or subcontract, state the name of each officer, partner or employee and the name of the organization and owner(s), and the explanation of litigation or reasons why the contract or subcontract was not completed.

3.5 Identify your organizations Experience Modification Rating (EMR) \_\_\_\_\_. Attach a letter of explanation if your organization does not have an EMR.

3.6 Provide the name and attach a brief resume and list of similar success projects for your proposed Project Superintendent.

ARTICLE 4 ADDITIONAL QUALIFICATIONS

4.1. (Nominated Subcontractor only) Will you subcontract any part of the Work covered by the intended Sub agreement? \_\_\_\_\_. If so, which parts of the Work covered by the intended Sub agreement do you intend to subcontract to a lower tier Subcontractor?

4.2. State the name, address, and telephone number of a representative of your organization who personally visited and inspected the site: \_\_\_\_\_.

Also, describe, in an attachment to this Section 00420 Questionnaire, subsurface and physical conditions at or contiguous to the site that your representative investigated and how they were accounted for in the preparation of your organization's Bid.

4.3. Attach a list of construction equipment and machinery your organization intends to use in the execution of the Work, as estimated in the preparation of your organization's Bid.

4.4. Does your organization rent or lease equipment or facilities from other affiliate organizations? \_\_\_\_\_. If so, state the name of the affiliate organization(s) \_\_\_\_\_.

4.5. (Apparent Low Bidder only) Bank line of credit available? \$\_\_\_\_\_.

4.6. (Apparent Low Bidder only) Will your organization, i.e., the Bidder named in the Authorized Signature Article on Section 00300 Bid Form, be the only named Principal in Section 00610 Performance Bond and Section 00620 Payment Bond? \_\_\_\_\_. If not, please identify the organization who will be named as Principal or Co-Principal on Section 00610 Performance Bond and Section 00620 Payment Bond \_\_\_\_\_. Also, state how such organization relates to the Bidder \_\_\_\_\_. (NOTE: If another organization is identified, the Apparent Low Bidder shall submit to the Owner a separate Section 00420 Questionnaire filled out by that organization as part of the Qualification Submittals required under Article 2 of Section 00100 Instructions to Bidders).

ARTICLE 5 REFERENCES

5.1. Trade references (Minimum of three (3)):

5.2. Bank references:

5.3. Insurance:

The undersigned Apparent Low Bidder \_\_\_\_\_ or nominated Subcontractor \_\_\_\_\_ certifies that all statements and answers made to the interrogatories in this Section 00420 Questionnaire are current, accurate and complete as of the date stated below. (Note: Attachments shall be fastened at the end of this Section).

Signed by: \_\_\_\_\_ Name \_\_\_\_\_ Title \_\_\_\_\_

on this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

END OF SECTION 00420

**REFERENCES ATTACHMENT**

**PROFESSIONAL** – WTA Architects

WORK – Center for Forensic Psychiatry - Create Kitchen

AGENCY No. – 491 FUNDING CODE. 171CODHHS7255 FILE No. 491/20167.SDW

**REFERENCE #**

Public Owner: \_\_\_\_\_

Project/Contract Name: \_\_\_\_\_

Location of Project/Contract: \_\_\_\_\_

Contract Price: \_\_\_\_\_ Project/Contract Started: \_\_\_\_\_ Completed: \_\_\_\_\_

Owner's Representative (Name and Telephone): \_\_\_\_\_

Apparent Low Bidder's \_\_\_\_ or Nominated Subcontractor's \_\_\_\_  
Representative Name and Telephone \_\_\_\_\_

Scope of Project/Contract: \_\_\_\_\_

**REFERENCE #**

Public Owner: \_\_\_\_\_

Project/Contract Name: \_\_\_\_\_

Location of Project/Contract: \_\_\_\_\_

Contract Price: \_\_\_\_\_ Project/Contract Started: \_\_\_\_\_ Completed: \_\_\_\_\_

Owner's Representative (Name and Telephone): \_\_\_\_\_

Apparent Low Bidder's \_\_\_\_ or Nominated Subcontractor's \_\_\_\_  
Representative Name and Telephone \_\_\_\_\_

Scope of Project/Contract: \_\_\_\_\_

**REFERENCES ATTACHMENT****PROFESSIONAL – WTA Architects**

WORK – Center for Forensic Psychiatry - Create Kitchen

AGENCY No. – 491 FUNDING CODE. 171CODHHS7255 FILE No. 491/20167.SDW

**REFERENCE #**

Public Owner: \_\_\_\_\_

Project/Contract Name: \_\_\_\_\_

Location of Project/Contract: \_\_\_\_\_

Contract Price: \_\_\_\_\_ Project/Contract Started: \_\_\_\_\_ Completed: \_\_\_\_\_

Owner's Representative (Name and Telephone): \_\_\_\_\_

Apparent Low Bidder's \_\_\_\_ or Nominated Subcontractor's \_\_\_\_

Representative Name and Telephone \_\_\_\_\_

Scope of Project/Contract: \_\_\_\_\_

**REFERENCE #**

Public Owner: \_\_\_\_\_

Project/Contract Name: \_\_\_\_\_

Location of Project/Contract: \_\_\_\_\_

Contract Price: \_\_\_\_\_ Project/Contract Started: \_\_\_\_\_ Completed: \_\_\_\_\_

Owner's Representative (Name and Telephone): \_\_\_\_\_

Apparent Low Bidder's \_\_\_\_ or Nominated Subcontractor's \_\_\_\_

Representative Name and Telephone \_\_\_\_\_

Scope of Project/Contract: \_\_\_\_\_

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**SECTION 00430 LIST OF SUBCONTRACTORS**

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**PROFESSIONAL** – WTA Architects

WORK – Center for Forensic Psychiatry - Create Kitchen

AGENCY No. – 491 FUNDING CODE. 171CODHHS7255 FILE No. 491/20167.SDW

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1. To enable the **Owner** and **Professional** to evaluate the Apparent Low Bidder's qualifications to perform the Work, for each Division of the Specifications, Section of the Specifications and/or trade itemized in this Section 00430 List of Subcontractors, the Apparent Low Bidder shall nominate the Subcontractor(s) to be awarded a Sub agreement(s). To the extent a contractor's licensing is required for any such classification of Work, the Apparent Low Bidder shall provide the nominated Subcontractor's license number(s). If the Apparent Low Bidder intends to self-perform any of the listed classifications of Work, the Apparent Low Bidder shall nominate itself in the spaces provided for that purpose and shall furnish the corresponding Apparent Low Bidder's license number(s). For each nominated Subcontractor, the Apparent Low Bidder shall enter, if applicable, whether the Subcontractor is a minority, woman or handicapped owned business in the spaces provided for that purpose. The Apparent Low Bidder also shall furnish the amount of the Sub agreement that the Apparent Low Bidder, directly or through another higher tier Subcontractor, anticipates awarding to each nominated Subcontractor.

2. Should the Apparent Low Bidder fail to nominate Subcontractors, as required, or provide duplicate nominees for any Division, Specification, or trade, or fail to enter the required licensing information, the Apparent Low Bidder shall clarify the omission or ambiguity within two (2) Business Days of the **Owner** or **Professional's** request. Failure by the Apparent Low Bidder to comply with this Subcontractor nominating requirement may render the Bid as not conforming in all material respects with the requirements of the Bidding Documents.

3. Pursuant to the Bidding Documents, the Apparent Low Bidder shall not remove, replace, or add a nominated Subcontractor except as provided in paragraph 8.3 of Section 00100 Instructions to Bidders and/or in paragraph 5.1 of Section 00700 General Conditions. Since the requirement to nominate Subcontractors for the *listed* Divisions, Specification Sections and/or trades survives the award of the Contract, any Subcontractor nominated for any *listed* Division, Specification Section and/or trade *for the first time* after Contract Award and who is objected to by the **Owner**, for good cause, shall be replaced at no increase in Contract Price and/or Contract Time.

4. The requirement to make a definite nomination of Subcontractors or to state that the Apparent Low Bidder intends to self-perform that classification, and to clarify any omissions or ambiguities in this Section 00430 List of Subcontractors, applies to the Apparent Low Bidder and any other Bidder remaining or wishing to remain in contention for the award.

5. This listing requirement is not intended to create any express or implied duty or obligation to the Apparent Low Bidder or the nominated Subcontractors by the **Owner** or **Professional**.

(THE REMAINDER OF THIS PAGE LEFT BLANK INTENTIONALLY)

Division, Specification Section and/or Trade	Nominated Subcontractor(s)	License Number(s) Classification	Amount of Subcontract
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____
7. _____	_____	_____	_____
8. _____	_____	_____	_____
9. _____	_____	_____	_____
10. _____	_____	_____	_____
11. _____	_____	_____	_____
12. _____	_____	_____	_____
13. _____	_____	_____	_____
14. _____	_____	_____	_____

The undersigned Apparent Low Bidder \_\_\_\_\_ certifies that all the information and data furnished in this Section 00430 List of Subcontractors are current, accurate and complete as of the date stated below.

Signed by: \_\_\_\_\_ Name \_\_\_\_\_ Title \_\_\_\_\_

on this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

**END OF SECTION 00430**

**PROFESSIONAL** – WTA Architects

WORK – Center for Forensic Psychiatry - Create Kitchen

AGENCY No. – 491 FUNDING CODE. 171CODHHS7255 FILE No. 491/20167.SDW

**ARTICLE 1 BID MATERIALS AND EQUIPMENT – LISTED (NAMED OR SPECIFIED) ITEMS**

1.1. The Apparent Low Bidder has examined the requirements of paragraphs 7.4 and 7.5 of Section 00100 Instructions to Bidders, and by submitting a Bid, commits to bid only a *listed* named or specified materials and equipment for those Specifications *listed* in Schedule 1.6. To the extent that any such *listed* Specification states that an "or equal" or a substitute may be furnished, if acceptable to the **Professional**, application for any such acceptance will not be considered by the **Professional** until after Contract Award. Any such application shall comply with the terms and conditions of Article 2 in this Section and paragraph 5.2 of Section 00700 General Conditions.

1.2. For those Sections of the Specifications *listed* in paragraph 1.6, the Contract will be awarded on the basis that only one of the *listed* materials or equipment will be furnished. Therefore, to be considered responsible, the Apparent Low Bidder shall nominate, by circling the letters "A," "B," "C," etc. corresponding to each *listed* manufacturer/Supplier, the Bidder's chosen manufacturers/Suppliers for the corresponding products named or specified in the Specifications and Drawings (including all Addenda).

1.3. If the Apparent Low Bidder fails to circle a manufacturer/Supplier for a *listed* material or equipment, or circles more than one letter for a *listed* material or equipment, the Apparent Low Bidder hereby agrees to correct the omission or ambiguity within two (2) Business Days after submittal of this Section 00440 Schedule of Materials and Equipment. The requirement to make a definite selection and to correct any omissions or ambiguities in Schedule 1.6 applies to the Apparent Low Bidder and any other Bidder remaining or wishing to remain under consideration for the award.

1.4. The Apparent Low Bidder's attention is directed to paragraph 7.3 of Section 00100 Instruction to Bidders, which holds the Apparent Low Bidder responsible, if awarded the Contract, for certain costs and time impacts, provided the Apparent Low Bidder, in the preparation of its Bid, knew or had reason to know, that any *listed* material or equipment bid by the Bidder requires changes in the Work and failed to provide advanced written notice to that effect to the **Professional**.

1.5. The Apparent Low Bidder shall insert the provisions of this Section in all Sub agreements with Subcontractors and Suppliers furnishing the materials or equipment *listed* in Schedule 1.6, altering the respective paragraphs only as appropriate to properly identify the contracting parties. Each such Sub agreement shall expressly bind the respective Subcontractor or Supplier to the conditions of paragraph 1.4, the other provisions of Section 00440 Schedule of Materials And Equipment and paragraph 5.2 of Section 00700 General Conditions.

**1.6. Schedule of Bid Materials and Equipment**

ITEMS NAMED OR SPECIFIED (ENTERED BY THE <b>PROFESSIONAL</b> )		<b>CONTRACTOR TO NOMINATE (CIRCLE) ITS CHOSEN NAMED OR SPECIFIED MANUFACTURERS AND SUPPLIERS</b>
ITEM OF MATERIAL OR EQUIPMENT	SPECIFICATION SECTION	
ITEM 1 -		A. B. C. D.
ITEM 2 -		A. B. C. D.
ITEM 3 –		
ITEM 4 -		

**1.7 Use of "Or Equal" or Substitute Materials or Equipment After Contract Award**

1.7.1. Paragraph 5.2 of Section 00700 General Conditions provides for the consideration (after the date of Contract Award) and possible acceptance by the **Professional** of "or equal" or substitute materials or equipment (unless any material or equipment named is followed by words establishing that no "or equal" or substitution is permitted). If sufficient information is submitted to allow the **Professional** to determine in a timely manner that the material or equipment proposed is equivalent or equal to that named or described in the Drawings or specified in the Specifications, then the **Professional** will consider the proposed "or equal" or substitute material or equipment.

1.7.2. The Apparent Low Bidder assumes responsibility for the cost and time required to make any proposed "or equal" or substitute material or equipment approved by the **Professional** conform to the requirements of the Contract Documents. In addition, if any such "or equal" or substitute material or equipment requires any changes in the drawings, or in any testing requirements, or in any Means and Methods indicated in or required by the Contract Documents, or in work performed by the **Owner** or others, or requires any other changes in the Work whatsoever, the Apparent Low Bidder shall assume full responsibility for the cost and the time required to carry out such changes in the Work or the work of others. Pursuant to this provision, the Apparent Low Bidder shall bear an appropriate portion of the Delay and costs resulting from the events contemplated in this paragraph.

1.7.3. Paragraph 5.2 of Section 00700 General Conditions provides for reimbursement by the **Contractor** to the **Owner** for any additional expenses incurred by the **Professional** directly attributable to the evaluation of any proposed substitute material or equipment and any proposed "or equal" material or equipment for materials and equipment *listed* in Schedule 1.6.

1.7.4. The Apparent Low Bidder shall insert the provisions of this Article 1 of Section 00440 Schedule of Materials and Equipment in all Sub agreements with Subcontractors and Suppliers furnishing any materials or equipment, altering the respective paragraphs only as appropriate to properly identify the contracting parties. Each such Sub agreement shall expressly bind the respective Subcontractor or Supplier to the conditions of paragraph 1.7.2, the other provisions of this Section 00440 Schedule of Materials And Equipment and paragraph 5.2 of Section 00700 General Conditions.



**ARTICLE 2 BID MATERIALS AND EQUIPMENT – OPEN SPECIFICATIONS**

2.1. For those Specifications *not listed* in Schedule 1.6, the Apparent Low Bidder, if and when awarded the Contract, shall disclose to the **Owner** and **Professional** (when submitting the Schedule of Values required by paragraph 12.1.1 of Section 00700 General Conditions) the Bidder's chosen manufacturers/Suppliers for the corresponding materials and equipment specified in the Specifications and Drawings (including all Addenda).

2.2. The Apparent Low Bidder has examined the requirements of paragraphs 7.2 and 7.3 of the Instructions to Bidders and commits to furnish materials and equipment meeting the requirements of the Specifications. If any such Bidder-selected material or equipment represents an "or equal" or a substitute material or equipment, no such material or equipment shall be used or furnished in the execution of the Work unless previously approved by the **Professional** as an acceptable "or equal" or substitute material or equipment. Application for any such acceptance will not be considered until after Contract Award. Any such application shall comply with the terms and conditions of this Article 2 and paragraph 5.2 of Section 00700 General Conditions.

2.3. The Apparent Low Bidder shall insert the provisions of this Section in all Sub agreements with Subcontractors and Suppliers furnishing the materials or equipment listed in Schedule 2.4, altering the respective paragraphs only as appropriate to properly identify the contracting parties. Each such Sub agreement shall expressly bind the respective Subcontractor or Supplier to the conditions of paragraph 2.2, the other provisions of this Section 00440 Schedule of Materials and Equipment and paragraph 5.2 of Section 00700 General Conditions.

**2.4. Schedule of Bid Materials and Equipment**

MATERIAL OR EQUIPMENT	SPECIFICATION SECTION	CONTRACTOR TO NAME ITS CHOSEN MANUFACTURERS AND SUPPLIERS
ITEM 1 -		
ITEM 2 -		
ITEM 3 -		
ITEM 4 -		
ITEM 5 -		
ITEM 6 -		
ITEM 6 -		
ITEM 7 -		
ITEM 8 -		
ITEM 9-		
ITEM 10 -		
ITEM 11-		
ITEM 12 -		

MATERIAL OR  
EQUIPMENTSPECIFICATION  
SECTION**CONTRACTOR TO NAME ITS  
CHOSEN MANUFACTURERS  
AND SUPPLIERS**

**IMPORTANT:** The provisions of this Section 00440 Schedule of Materials and Equipment shall not create or impose any express or implied duty or obligation on the **Owner** or **Professional** to exercise this authority for the benefit of the Apparent Low Bidder or any *listed* manufacturer/Supplier.

The undersigned Apparent Low Bidder \_\_\_\_\_ certifies that all the information and data furnished in this Section 00440 Schedule of Materials and Equipment are current, accurate and complete as of the date stated below.

Signed by: \_\_\_\_\_ Name \_\_\_\_\_ Title \_\_\_\_\_

on this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

**END OF SECTION 00440**

AGENCY No. 491 Funding Code: 171CODHHS7255FILE No. 491/20167.SDW CONTRACT ORDER No. Y \_\_\_\_\_**TABLE OF CONTENTS**

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** To Be Completed Upon Award of the Contract **	

\*\*THIS AGREEMENT TO CONTRACT is made this \_\_\_\_\_ day of \_\_\_\_\_ in the year Two-Thousand And \_\_\_\_\_ (\_\_\_\_\_) by and between THE STATE OF MICHIGAN, "Owner," represented by the Director, Department of Technology, Management and Budget, duly authorized, and \_\_\_\_\_, \_\_\_\_\_ the "Contractor," a corporation \_\_\_\_\_, partnership \_\_\_\_\_, individual \_\_\_\_\_, or joint venture \_\_\_\_\_ (between \_\_\_\_\_ and \_\_\_\_\_), of the State of \_\_\_\_\_, whose address is \_\_\_\_\_, represented by \_\_\_\_\_, its \_\_\_\_\_, duly authorized.

The Owner and Contractor, in consideration of the mutual covenants and obligations stated in this Section 00500 Agreement and the other parts of the Contract Documents, agree as follows:

**ARTICLE 1 THE CONTRACT; THE PROJECT; THE WORK**

1.1. THE CONTRACT – The Contract entered between the Owner and Contractor for the furnishing and performance of the Work by the Contractor, which consists of the Contract Documents listed or designated in paragraphs 2.2 through 2.4.

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1.2. PROJECT NAME – **CENTER FOR FORENSIC PSYCHIATRY - CREATE KITCHEN**

1.3. THE WORK – **New addition to existing structure for commercial kitchen and dining space.**

**ARTICLE 2 CONTRACT DOCUMENTS**

2.1. The Contract Documents form the contract between the Owner and Contractor and represent the entire and final integrated agreement between the Owner and Contractor with respect to the Work. The Contract Documents are incorporated into this Agreement by this reference, and supersede all prior oral or written agreements, if any, between the Owner and Contractor. Any statement, representation, promise or inducement not set forth in the Contract Documents is null and void, and not binding on either the Owner or Contractor. The Contract Documents shall not in any way create a relationship of any kind between the Professional and Contractor, or between the Owner and a Subcontractor, or Supplier or any other third party. The Professional shall, however, be entitled to performance and enforcement of obligations under the Contract that are consistent with the Professional's authority and responsibilities under the Contract Documents.

2.2. The Contract Documents on the date when the Owner executes this Section 00500 Agreement, which are attached to this Section 00500 Agreement, consist of the following:

2.2.1. This **Section 00500 Agreement**, fully executed by the Owner and Contractor, including the following attachments: \_\_\_\_\_ and **Addenda** \_\_\_\_\_ through \_\_\_\_\_.

2.2.2. **Section 00800 Supplementary Conditions**, including \_\_\_\_\_; and **Section 00120 Supplementary Instructions**, including \_\_\_\_\_

2.2.3. **Section 00020 Glossary**, and **Section 00700 General Conditions**.

2.2.4. **General Requirements**, Division 1 of the Specifications.

2.2.5. **Divisions 2 through \_\_\_\_\_ of the Specifications**, and **Drawings**, bearing the title: \_\_\_\_\_, dated \_\_\_\_\_.

2.2.6. **Section 00030 Advertisement; Section 00100 Instructions to Bidders**, including **Attachment A–Bidder's Check List**, and **Section 00210 Information for Bidders**.

2.2.7. **Section 00610 Performance Bond** and **Section 00620 Payment Bond**, fully executed by the Contractor and the sureties, each enclosing separate evidence of Power of Attorney.

2.2.8. The Contractor's **Section 00300 Bid Summary and Bid Form** (with attachments) and **Section 00320 Non-collusion Affidavit** (including any revisions delivered after Bid opening).

2.2.9. The following **Contractor's Qualification Submittals** (post-Bid opening:)

2.3. Contract Documents that will be issued after the date the **Owner** executes this Section 00500 Agreement consist of:

2.3.1. **Change Orders** and **Change Authorizations** signed as provided in the Contract Documents.

2.3.2. **Notice of Award** and **Notice to Proceed**.

2.4. There are no Contract Documents other than those listed or designated in this Article or added through Section 00520 Attachment A to the Agreement. The Contract Documents may be modified, as provided in Section 00700 General Conditions.

### ARTICLE 3 CONTRACT PRICE

3.1. The **Contractor** will furnish and perform the Work and accept in full payment the Contract Price of \_\_\_\_\_ Dollars (\$\_\_\_\_\_). The Contract Price includes only those Alternates accepted by the **Owner**, as itemized in the Notice of Award.

3.2. The Contract will include those Change Order prices (bid on Section 00300 Bid Form) accepted by the **Owner** when the **Owner** issues the Notice to Proceed or by Change Authorization.

3.3. Payments to the **Contractor** will be made based on the prices stated on the **Contractor's** Section 00300 Bid Form, subject to the terms and conditions of the Contract Documents.

### ARTICLE 4 CONTRACT TIME; LIQUIDATED DAMAGES

4.1. The periods allowed for completion of the Work, or a designated part of the Work, will be as follows:

4.1.1. The entire Work will be substantially complete in accordance with the requirements of the Contract Documents **All Work shall be Substantially Complete by 12/20/2025**

4.1.2. If separable parts of the Work shall be completed before the period allowed for Substantial Completion of the entire Work, the Contract Times for those parts of the Work will be as specified in Section 00520 Attachment A to Agreement, and as may be supplemented in the Specifications.

4.1.3. The entire Work will be complete and ready for final payment as specified in the Contract Documents: **All Work shall be complete by 1/20/2025**

4.2. The **Owner** and **Contractor** recognize that the Contract Times are of the essence of the Contract and that the **Owner** will suffer costs and damages if the Work is not completed within the Contract Times, including any extensions in Contract Time authorized by Change Orders. Therefore, liquidated damages (in the amounts specified in paragraphs 4.2.3 through 4.2.5) will apply if the Work is not completed within the limits of the Contract Times. Liquidated damages are not a penalty, are cumulative and represent a reasonable estimate of the **Owner's** extra costs and damages, which are difficult to estimate with accuracy in advance.

4.2.1. Accordingly, if the **Contractor** fails, neglects, or refuses to complete all or any designated part of the Work within the specified Contract Time, the **Contractor** agrees to pay to the **Owner** liquidated damages and to allow, at the appropriate time, a corresponding adjustment in Contract Price.

4.2.2. If under the procedures of paragraph 4.3, the **Owner** is justified in withholding liquidated damages due to or in anticipation of late completion, the **Contractor** agrees to allow the **Owner** to deduct liquidated damages from Requests for Payment.

4.2.3. Liquidated damages for each Calendar Day that expires after the Contract Time specified in paragraph 4.1.1 for Substantial Completion of the entire Work – until the Work is substantially complete – shall be in the amount of **Five Hundred Dollars and No/Cents (\$500.00)**.

4.2.4. Liquidated damages for each Calendar Day that expires after each of the Contract Times designated in Section 00520 Attachment A to the Agreement – until each such part of the Work is sufficiently complete – shall be in the amounts stated in Section 00520 Attachment A to the Agreement.

4.2.5. Liquidated damages for each Calendar Day after Substantial Completion of the entire Work that expires after the Contract Time specified in paragraph 4.1.3 for completion and readiness for final payment – until the entire Work is complete and ready for final payment – shall be in the amount of **Five Hundred Dollars and No/Cents (\$500.00)**

#### Assessment and/or Withholding of Liquidated Damages

4.3. If the **Contractor** fails to complete the Work, or a specified part of the Work, within the corresponding Contract Time, or if at any time after the Work is eighty percent (80%) in place, the **Contractor** does not prosecute the balance of the Work with the diligence required to comply with the Contract Times, the **Contractor** shall be requested to submit a schedule recovery plan acceptable to the **Owner**. The **Contractor's** schedule recovery plan shall describe the cause of schedule slippage or delayed progress and the actions proposed and taken to recover schedule. In addition, to the extent that the **Contractor** believes that an extension in Contract Time is justified, the recovery plan shall include a request for an appropriate extension in Contract Time.

4.3.1. Within fifteen (15) Calendar Days after the **Contractor** receives any such request, the **Contractor** shall meet with the **Owner** and present the **Contractor's** written schedule recovery plan. If, upon evaluation of the **Contractors'** schedule recovery plan, and after consultation with the **Professional**, the **Owner**, in its sole discretion, determines that there is sufficient cause to withhold liquidated damages, the **Owner** may deduct from Requests for

Payment the liquidated damages then due or that would become due using the **Owner's** estimate of late completion of the Work.

4.3.2. For the purposes of returning liquidated damages, schedule recovery implementation shall not be complete until such slippage or delayed progress has been corrected and the Progress Schedule once again supports compliance with the Contract Times. Once late completion has been corrected, the **Contractor** shall be entitled to reimbursement of all liquidated damage sums previously withheld. Any such reimbursement of liquidated damages previously withheld shall not constitute a waiver of any claims that the **Owner** may otherwise have.

#### ARTICLE 5 PAYMENTS TO CONTRACTOR

\*5.1. The **Owner** will pay one hundred percent (100%) of the amount due upon completion of any Schedule of Value *pay item*. The **Professional** may require, for each Request for Payment, sworn statements, consent of surety, waivers of lien (from the **Contractor**, Subcontractors and Suppliers), Record Documents, guarantees, operating and maintenance manuals and such other documents required by the Contract Documents. Payment to the **Contractor** will be made within thirty (30) Calendar Days from receipt by the **Owner** of the **Professional's** certification representing to the **Owner** the amount of payment to be due to the **Contractor**.

\*5.2. Processing of Requests for Payment by the **Owner** may be deferred until Work having a prior sequence, as provided in the Contract Documents, is in place and is approved.

5.3. Payments shall be subject to the terms and conditions of Section 00700 General Conditions and the other parts of the Contract Documents and shall be made less such deductions as the **Owner** and/or **Professional** determines are appropriate, as specified in paragraph 12.4 of Section 00700 General Conditions.

5.4. If any portion of the Work is funded by a federal or State agency, the **Owner** will have fifteen (15) Calendar Days after receiving those funds in which to make payment. This provision shall take effect only after the thirty (30) Calendar Day period following certification by the **Professional** has expired.

#### ARTICLE 6 THE PROFESSIONAL SERVICES CONTRACTOR

6.1. The **Owner** has retained **WTA Architects** to assume all duties and responsibilities of, and have the rights and authority assigned to, the **Professional Services Contractor** in the Contract Documents with respect to completion of the Work in accordance with the Contract Documents.

#### ARTICLE 7 CONTRACTOR'S REPRESENTATIONS

7.1. The **Contractor** reiterates and makes each of the representations itemized in Article 2 of the **Contractor's** Section 00300 Bid Form. Article 2 in the **Contractor's** Section 00300 Bid Form is by this reference repeated verbatim in this Section 00500 Agreement as paragraphs 7.2 through 7.13 just as though those paragraphs had been written in this Article 7, except that the term "**Contractor**" shall replace the term "Bidder" in every instance.

#### ARTICLE 8 MISCELLANEOUS

8.1. If any provision of the Contract Documents is invalid, illegal, or unenforceable, all other provisions of the Contract Documents shall remain in full force and effect. If any provision of the Contract Documents is inapplicable to any Person or circumstance, that provision shall remain applicable to all other Persons and circumstances.

8.2. It is the intent of the **Owner** and **Contractor** that all provisions of Law required to be inserted or referenced in the Contract Documents are in fact so inserted or referenced. If any provision of Law is not so inserted or referenced, or is inserted or referenced improperly, then each such provision shall be considered inserted or referenced in the Contract Documents in proper form at no increase in Contract Price and/or Contract Time.

8.3. The duties, obligations, criteria or procedure imposed by, and the rights and remedies made available in, the Contract Documents are in addition to, and not in any way a limitation of, any rights and remedies that are otherwise allowed or imposed by Law, except that in the event a specific part or detailed requirement of a provision, criterion or procedure in the Contract Documents and a specific part or detailed requirement of a provision, criterion or procedure imposed by Law conflict, the specific part or detailed requirement of such provision, criterion or procedure imposed by Law shall govern. All other specific parts or detailed requirements in the provisions, criteria or procedures imposed by Law and the Contract Documents shall remain in full force and effect and be read with the controlling specific part or detailed requirement. These provisions will be as effective as if repeated specifically in the Contract Documents in connection with each duty, obligation, right and remedy to which they apply.

8.4. The **Contractor** shall not sell, assign, transfer or otherwise convey any of the **Contractor's** rights and shall not delegate any of the **Contractor's** duties under this Agreement without the prior written consent of the **Owner** and the sureties for the **Contractor**. In its sole discretion, the **Owner** may refuse to consent to any proposed assignment or delegation. Any attempted sale, assignment, transfer, or other conveyance in violation of this paragraph shall be void and shall relieve the **Owner** of any further liability under the Contract Documents but shall not relieve the **Contractor's** sureties of any liability. If the **Owner** consents in writing to an assignment, unless specifically stated to the contrary in the consent, that assignment shall not release or discharge the **Contractor** from any duty or responsibility set forth in the Contract Documents and shall not release or discharge the **Contractor's** sureties under the Bonds required by the Contract Documents.

8.5. The **Owner** reserves the right to correct any error in any Request for Payment that may have been paid. The **Owner** reserves the right, should proof of Defective Work be discovered after final payment, to claim and recover from the **Contractor** and/or the **Contractor's** surety, sufficient sums to correct or remove and replace the Defective Work.

8.6. Any waiver by the **Owner** of any provision of the Contract Documents shall be specific and in writing and apply only to the specific matter and not to other similar or dissimilar matters. Any waiver of any breach of this Contract shall not be held to be a waiver of any other or subsequent breach.

8.7. Nothing contained in this Agreement shall in any manner authorize, empower, or constitute the **Contractor**, Subcontractors

or Suppliers (a) to act as agents of the **Owner**, (b) to assume or create any obligation or responsibility whatsoever, express, or implied, on behalf of or in the name of the **Owner**; (c) to bind the **Owner** in any manner, or (d) to make any representation, warranty, covenant, agreement, or commitment on behalf of the **Owner**. It is the intent and understanding of the parties that the **Contractor** shall perform the Work as an independent contractor. This Agreement does not create, and shall not be construed as creating, any rights enforceable by any third party.

8.8. If the **Owner** or **Contractor** suffers injury or damage to person or property because of error, omission, or act of the other, any of the other's employees or agents or others for whose acts the other party is legally liable, claim will be made in writing to the other party within a reasonable time of the first observation of that injury or damage. This provision is not and shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or time requirements set forth in Section 00700 General Conditions.

8.9. All computer programs which are not the subject of copyrights by third parties, and which are delivered, developed, produced, or paid for under a specific requirement of the Contract Documents and all plans, drawings, designs, specifications, technical reports, operating manuals, and other data which are delivered, developed, produced, or paid for under the Contract Documents shall be the property of the **Owner**. The **Owner** maintains all rights to such programs and deliverables, including the right to use, duplicate, and disclose the programs and deliverables, in whole or in part, in any manner and for any purpose. If any program or deliverable is copyrightable, the **Contractor** may copyright it subject to the **Owner's** rights. The **Owner** reserves a royalty-free, nonexclusive, and irrevocable license to use, duplicate, publish, and disclose such programs and deliverables, in whole or in part, and to authorize others to do so.

8.10. The **Contractor** warrants that all costs in proposals and claims for adjustments in Contract Price shall not exceed those allowed under the Contract Documents, and that proposals and claims for adjustments in Contract Price shall grant prices, terms, and warranties comparable to or better than prices, terms and warranties offered to others for similar work.

8.11. This Agreement shall be binding on the **Contractor**, **Owner** and their respective successors and legal representatives and, if the **Owner** has consented to an assignment or other conveyance, on all their respective assigns and delegates.

\*8.12. The Contract Documents shall be governed by and construed in accordance with the Laws of the State of Michigan in effect on the date of Bid opening. Any change in Michigan Law after that date shall be binding only to the extent the **Owner** and **Contractor** agree or to the extent such change is beyond the capacity of the parties to avoid.

**ARTICLE 9 NOTICE AND SERVICE**

9.1. Unless otherwise provided in the Contract Documents or consented to by the **Owner** in writing, any notice, demand, or communication shall be in writing and shall be deemed to have been given when received by the individual required to be given notice at the address designated in this Agreement. A copy of any notice, demand or notification shall be sent to the address below.

9.2. Any written notice or other written communication to the sureties shall be sufficiently given if delivered to the individual required to be given notice at the address designated in the Bond.

IN WITNESS WHEREOF, the **Owner** and **Contractor** have signed this Section 00500 Agreement in triplicate and initialed three (3) full sets of the Contract Documents. One (1) full set of the executed Contract Documents will be delivered to the **Contractor**.

**THE STATE OF MICHIGAN**

BY:

\_\_\_\_\_  
**Director**, DTMB, SFA, Design and Construction  
NAME:

\_\_\_\_\_  
Witness:

\_\_\_\_\_  
Date:

\_\_\_\_\_  
Address for giving notices:

Department of Technology, Management and Budget  
State Facilities Administration  
Design and Construction  
3111 W. St. Joseph Street  
Lansing, MI 48917

BY:

\_\_\_\_\_  
Title: \_\_\_\_\_ Date \_\_\_\_\_

NAME:

\_\_\_\_\_  
Federal ID No. or SS No. (LAST 4 Only) \_\_\_\_\_

\_\_\_\_\_  
Telephone No.

\_\_\_\_\_  
Witness:

\_\_\_\_\_  
Date:

\_\_\_\_\_  
Address for giving notices

**THE CONTRACTOR**

**CERTIFICATE OF PRINCIPAL**

(If **Contractor** is Other Than a Sole Proprietor)

I, \_\_\_\_\_, certify that I am the Secretary of the Corporation \_\_\_\_\_, or a General Partner \_\_\_\_\_ or Managing Partner \_\_\_\_\_ or Partner \_\_\_\_\_ of the partnership, named as the **Contractor** in the attached Section 00500 Agreement, that \_\_\_\_\_ who signed Section 00500 Agreement on behalf of the **Contractor**, was then \_\_\_\_\_ of that corporation \_\_\_\_\_ or partnership \_\_\_\_\_; that I know the undersigned's signature, and the signature is genuine; and that Section 00500 Agreement was duly signed, sealed and attested for and on behalf of that corporation \_\_\_\_\_ partnership \_\_\_\_\_ by authority of its governing body \_\_\_\_\_ or partners \_\_\_\_\_

\_\_\_\_\_  
Signed by the Secretary or Other Authorized Officer of the Corporation \_\_\_\_\_ Date  
or By General Partner or Managing Partner or Authorized Partner Certifying

\_\_\_\_\_  
Name of the Corporation or True Name of the Partnership

Telephone No. \_\_\_\_\_

(Corporate Seal)

**VERIFICATION**  
(by **Contractor**)

STATE OF \_\_\_\_\_ )

COUNTY OF \_\_\_\_\_ )

Before me, a Notary Public duly commissioned, qualified and acting, personally appeared (enter name of person who signed Section 00500 Agreement on behalf of the Bidder), \_\_\_\_\_ to me well known, who being by me first duly sworn upon oath, says that he/she is the Attorney-In-Fact for (enter the **Contractor's** name) \_\_\_\_\_ and that he/she has been authorized by (enter name of individual, partnership name, or that governing body of the Bidder named in the attached corporate resolution) \_\_\_\_\_ to execute Section 00500 Agreement on behalf of the named **Contractor** in favor of the STATE OF MICHIGAN.

Subscribed and sworn before me this \_\_\_\_\_ day of \_\_\_\_\_, A.D., 20\_\_\_\_\_.

\_\_\_\_\_

Notary Public, State of \_\_\_\_\_

My Commission Expires: \_\_\_\_\_

**RESOLUTION OF CORPORATE AUTHORITY**  
(If Contractor is a Corporation)

I, \_\_\_\_\_, Corporate Officer of \_\_\_\_\_, a \_\_\_\_\_  
(Print or type) Corporation (the "Company") (Indicate State)

DO HEREBY CERTIFY that the following is a true and correct excerpt from the minutes of the meeting of the Board of Directors, wherein a quorum was present, duly called and held on \_\_\_\_\_ and that the same is now in full force and effect:

"RESOLVED, that the Chairman, the President, each Vice President, the Treasurer, and the Secretary and each of them, hereby is authorized to execute and deliver, in the name and on behalf of the Company and under its corporate seal or otherwise, any agreement or other instrument or document in connection with any matter or transaction that shall have been duly approved; the execution and delivery of any agreement, document, or other instrument, or document in connection with any matter or transaction that shall have been duly approved; the execution and delivery of any agreement, document, or other instrument by any of such officers to be conclusive evidence of such approval."

I FURTHER CERTIFY that \_\_\_\_\_ is Chairman of the Board, \_\_\_\_\_ is President, \_\_\_\_\_ is Treasurer, and \_\_\_\_\_ is Secretary.

I FURTHER CERTIFY that any of the officers of the Company named in this Resolution of Corporate Authority are authorized to execute or guarantee and commit the Company to the conditions, obligations, stipulations, and undertakings contained in the Contract Documents for Agency No. 491, Funding Code. 171CODHHS7255, File No. 491/20167.SDW Work Center for Forensic Psychiatry - Create Kitchen, and that all necessary corporate approvals have been obtained in relationship thereto

IN WITNESS THEREOF, I have set my hand this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

**CORPORATE SEAL**

\_\_\_\_\_  
Corporate Officer's Signature

\_\_\_\_\_  
Title

Telephone No. \_\_\_\_\_



**CERTIFICATE OF PARTNERSHIP AUTHORITY**  
(If **Contractor** is a Partnership)

I, \_\_\_\_\_, General Partner in \_\_\_\_\_, a \_\_\_\_\_  
(Print or Type) Partnership (the "Partnership") (Indicate State)

DO HEREBY CERTIFY that I am a General Partner in the Partnership formulated pursuant to a Partnership Agreement dated \_\_\_\_\_, 20\_\_\_\_, and that the following is a true and correct excerpt from the minutes of the meeting of the General Partnership held on \_\_\_\_\_ and that the same is now in full force and effect:

"That each General Partner is authorized to execute and deliver, in the name and on behalf of the Partnership, any agreement or other instrument or document in connection with any matter or transaction that shall have been duly approved; the execution and delivery of any agreement, document, or other instrument, or document in connection with any matter or transaction that shall have been duly approved; the execution and delivery of any agreement, document, or other instrument by a General Partner to be conclusive evidence of such approval."

I FURTHER CERTIFY that any of the aforementioned General Partners of the Partnership are authorized to execute or guarantee and commit the assets of the Partnership to the conditions, obligations, stipulations, and undertakings contained in the Contract Documents for Agency No. \_\_\_\_\_, Funding Code. \_\_\_\_\_, File No. \_\_\_\_\_ Work \_\_\_\_\_, \_\_\_\_\_ and that all necessary partnership approvals have been obtained in relationship thereto.

IN WITNESS THEREOF, I have set my hand this \_\_\_\_ day of \_\_\_\_\_, 20 \_\_\_\_.

\_\_\_\_\_  
General Partner's Signature

\_\_\_\_\_  
Title

Telephone No. \_\_\_\_\_

**END OF SECTION 00500**

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**SECTION 00520 ATTACHMENT "A" TO AGREEMENT**

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**PROFESSIONAL** – WTA Architects

WORK – Center for Forensic Psychiatry – Create Kitchen

AGENCY No. – 491 FUNDING CODE: 171CODHHS72255

FILE No. 491/2016.SDW CONTRACT ORDER No. Y

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This Section 00520 Attachment A to Agreement supplements those specific provisions in Section 00500 Agreement designated below. All other provisions in Section 00500 Agreement that are not so supplemented remain in full force and effect. The terms "Agreement", "Contract Documents" and "Contract" have specific intents and meanings assigned as stated in Section 00500 Agreement and Section 00020 Glossary.

**SUPPLEMENTARY TERMS AND CONDITIONS TO  
ARTICLE 4 CONTRACT TIME; LIQUIDATED DAMAGES**

The following separable parts of the Work will be completed, as specified in the Contract Documents:

- (a) All Work substantially complete, including issuance of Certificate of Occupancy on or before December 20, 2024.
- (b) All contractual Work, including site restoration complete on or before January 20, 2025.

These interim Contract Times are of the essence so as to: (a) not Delay work by others as provided in Article 13 of the General Conditions; (b) conform to the sequences of Work indicated in or required by the Contract documents; and (c) comply with the coordination requirements of the Contract Documents.

The **Owner** and **Contractor** recognize that the Contract Time(s) specified in this Attachment A is(are) of the essence to this Agreement in that the **Owner** will suffer costs and damages if the Work is not completed within the Contract Time(s) plus any extensions authorized in accordance with Section 00700 General Conditions. Accordingly, liquidated damages will apply based on the following schedule: (a) **Five Hundred** Dollars and No/Cents (\$500.00); and **Five Hundred** Dollars and No/Cents \$500.00 for each Calendar Day that expires after each of the respective Contract Times specified in this Section 00520 Attachment A to the Agreement for the completion of each of those designated parts of the Work, respectively, until each of those parts of the Work is complete. Any deduction by the **Owner** of liquidated damages from Requests for Payment shall be undertaken only after consultation with the **Professional** and shall be subject to the procedures outlined in paragraph 4.3, Section 00500 Agreement.

**END OF SECTION 00520**

SECTION 00610 PERFORMANCE BOND

AGENCY No. 491 Funding Code: 171CODHHS7255

FILE No. 491/20167.SDW SURETY COMPANY REFERENCE No. \_\_\_\_\_

KNOW ALL PERSONS BY THESE PRESENTS: That "the Contractor," \_\_\_\_\_, a corporation \_\_\_\_, individual \_\_\_\_, partnership \_\_\_\_, joint venture \_\_\_\_ of the State of \_\_\_\_\_, qualified to do business in the State of Michigan, as Principal, and "the Surety," \_\_\_\_\_, of the State of \_\_\_\_\_, as surety, are hereby held and firmly bound unto the State of Michigan, "the Owner," as Obligee, in the amount of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_), for the payment of which the Contractor and Surety hereby bind themselves, their respective heirs, successors, legal representatives and assigns, jointly and severally, firmly by these presents in compliance with 1963 PA 213, as amended, MCL 129.201 et seq.

WHEREAS, the Contractor has entered into "the Contract" with the Owner for Center for Forensic Psychiatry - Create Kitchen, "the Work," covered by the Contract Documents, which are incorporated into this Performance Bond by this reference;

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS THAT, if the Contractor faithfully performs and fulfills all the undertakings, covenants, terms, conditions, warranties, indemnifications and agreements of the Contract Documents within the Contract Time (including any authorized changes, with or without notice to the Surety) and during the Correction Period, and if the Contractor also performs and fulfills all the undertakings, covenants, terms, conditions, warranties, indemnifications and agreements of any and all duly authorized modifications of the Contract Documents, then THIS OBLIGATION SHALL BE NULL AND VOID, OTHERWISE TO REMAIN IN FULL FORCE AND EFFECT.

modification of the Contract Documents (including addition, deletion, or other revision).

B. This Section 00610 Performance Bond shall be solely for the protection of the Owner and its successors, legal representatives or assigns. The prevailing party in a suit on this Bond is entitled to recover as part of that party's judgment reasonable attorneys' fees.

C. It is the intention of the Contractor and Surety that they shall be bound by all terms and conditions of the Contract Documents (including, but not limited to Article 14 of Section 00700 General Conditions and this Section 00610 Performance Bond). However, this Section 00610 Performance Bond is executed pursuant to 1963 PA 213, as amended, MCL 129.201 et seq., and if any provision(s) of this Section 00610 Performance Bond is/are illegal, invalid, or unenforceable, all other provisions of this Section 00610 Performance Bond shall nevertheless remain in full force and effect, and the Owner shall be protected to the full extent provided by 1963 PA 213, as amended, MCL 129.201 et seq.

A. No change in Contract Price or Contract Time, "or equal" or substitution or modification of the Contract Documents (including addition, deletion, or other revision) shall release the Surety of its obligations under this Section 00610 Performance Bond. The Surety hereby expressly waives notice of any such change in Contract Price or Contract Time, "or equal" or substitution or

**IMPORTANT:** The Surety shall be authorized to do business in the State of Michigan by the Department of Consumer and Industry Services – Insurance Bureau, shall be listed on the current U.S. Department of the Treasury Circular 570, and, unless otherwise authorized by the Owner in writing, shall have at least an A– Best's rating and a Class VII or better financial size category per current A. M. Best Company ratings.

Name, Address and Telephone of the Surety:

Address and Telephone of Agent, who is either a resident of, or whose principal office is maintained in, the State of Michigan

Signed and sealed this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

THE CONTRACTOR: (Print Full Name and Sign) \_\_\_\_\_  
WITNESS \_\_\_\_\_

By: \_\_\_\_\_  
Name & Title: \_\_\_\_\_

THE SURETY: (Print Full Name and Sign)

Telephone No. \_\_\_\_\_  
Agent: \_\_\_\_\_

WITNESS \_\_\_\_\_

Attorney-in-Fact: \_\_\_\_\_  
Telephone No. \_\_\_\_\_

END OF SECTION 00610

SECTION 00620 PAYMENT BOND

AGENCY No. 491 Funding Code: 171CODHHS7255

FILE No. 491/20167.SDW SURETY COMPANY REFERENCE No.

KNOW ALL PERSONS BY THESE PRESENTS: That "the Contractor," a corporation, individual, partnership, joint venture of the State of Michigan, as Principal, and "the Surety," of the State of Michigan, as surety, are hereby held and firmly bound unto the State of Michigan, "the Owner," as Obligee, in the amount of Dollars (\$), for the payment of which the Contractor and Surety hereby bind themselves, their respective heirs, successors, legal representatives and assigns, jointly and severally, firmly by these presents in compliance with 1963 PA 213, as amended, MCL 129.201 et seq.

WHEREAS, the Contractor has entered into "the Contract" with the Owner for, "the Work," covered by the Contract Documents, which are incorporated into this Payment Bond by this reference.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS THAT, if the Contractor promptly pays all claimants supplying labor or materials to the Contractor or to the Contractor's Subcontractors in the prosecution of the Work, then THIS OBLIGATION SHALL BE NULL AND VOID, OTHERWISE TO REMAIN IN FULL FORCE AND EFFECT.

A. All rights and remedies on this Section 00620 Payment Bond shall be solely for the protection of all claimants supplying labor and materials to the Contractor or the Contractor's Subcontractors in the prosecution of the Work and shall be determined in accordance with Michigan Law.

B. No change in Contract Price or Contract Time, "or equal" or substitution or modification of the Contract Documents (including addition, deletion, or other revision) shall release the Surety of its obligations under this Section 00620 Payment Bond. The Surety

hereby expressly waives notice of any such change in Contract Price or Contract Time, "or equal" or substitution or modification of the Contract Documents (including addition, deletion, or other revision).

C. It is the intention of the Contractor and Surety that they shall be bound by all terms and conditions of the Contract Documents (including, but not limited to this Section 00620 Payment Bond). However, this Section 00620 Payment Bond is executed pursuant to 1963 PA 213, as amended, MCL 129.201 et seq., and if any provision(s) of this Section 00620 Payment Bond is/are illegal, invalid, or unenforceable, all other provisions of this Section 00620 Payment Bond shall nevertheless remain in full force and effect, and the Owner shall be protected to the full extent provided by 1963 PA 213, as amended, MCL 129.201 et seq.

IMPORTANT: The Surety shall be authorized to do business in the State of Michigan by the Department of Consumer and Industry Services – Insurance Bureau, shall be listed on the current U.S. Department of the Treasury Circular 570, and, unless otherwise authorized by the Owner in writing, shall have at least an A– Best's rating and a Class VII or better financial size category per current A. M. Best Company ratings.

Name, Address and Telephone of the Surety:

Address and Telephone of Agent, who is either a resident of, or whose principal office is maintained in, the State of Michigan

Signed and sealed this day of , 20.

THE CONTRACTOR: (Print Full Name and Sign)
WITNESS

By:
Name & Title:

THE SURETY: (Print Full Name and Sign)

Telephone No.
Agent:

WITNESS

Attorney-in-Fact:
Telephone No.

END OF SECTION 00620

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**STATE OF MICHIGAN MODEL**

Developed from FORMSPEC™ Michigan Model

These Model Specifications, known as the MICHSPEC™ 97.0820 Model Specifications, Sections 00500 through 00700 have been licensed to the State of Michigan, Department of Technology, Management and Budget (**DTMB**). Title to and use of these Specifications is strictly restricted. Except as authorized in writing by the Department of Technology, Management and Budget, State Facilities Administration, or as may be appropriate for their use in the bidding and execution of the Work, reproduction, translation or substantial use or quotation of any part of any of these Specifications beyond that permitted by the 1976 United States Copyright Act without the prior written permission is unlawful. Provisions marked with an asterisk have been furnished by the **DTMB** or have been taken from **DTMB**– provided contracts and are excluded from this copyright limitation.

**ARTICLE 1 INTERPRETATIONS**

**1.1 Section 00020 Glossary:**

1.1.1. Section 00020 Glossary assigns specific intent and meanings to capitalized terms and to other defined terms used in this Section 00700 General Conditions, Section 00500 Agreement, Section 00520 Attachment A to the Agreement, Section 00610 Performance Bond, Section 00620 Payment Bond, and Section 00800 Supplementary Conditions.

1.1.2. Section 00020 Glossary also provides specific rules for construing any reference to any Article or paragraph that is made in this Section 00700 General Conditions.

**1.2 Intent of the Contract Documents:**

1.2.1. The intent of the Contract Documents is to describe the *entire* Work, including its various parts, to the extent necessary for the **Contractor** to discharge its obligation to execute and complete the Work in accordance with the Contract Documents. The Contract Documents are complementary; what is required by one shall be as binding as if required by all Contract Documents.

1.2.2. The *entire* Work required by the Contract Documents includes Work, which is reasonably inferable from the Contract Documents or from prevailing custom and trade usage. The **Contractor** shall provide any Work reasonably inferable to the extent such Work is required to properly complete the installation of other Work expressly shown or specified in the Contract Documents. If the **Contractor** disagrees that Work that is not expressly shown or detailed in the Contract Documents is Work reasonably inferable, the **Contractor** shall proceed in accordance with the provisions of paragraph 10.1.3.

1.2.3. The breakdown of the Work by Divisions and Sections, or the identification of any Drawing, shall not delineate or be construed to delineate Work to be performed by any trade. The breakdown shall not control the manner in which the Work may be divided by the **Contractor** among Subcontractors and Suppliers.

\*1.2.4. Reference to the State Construction Code Act of 1972, 1972 PA 230, as amended, MCL 125.1501 *et seq.*, or to standard specifications, manuals or codes of any technical society, organization, or association, whether specifically or by implication, means the issue in effect on the date of Bid opening, unless otherwise expressly stated. Work indicated in or required by the Contract Documents that is above standards set in the State Construction Code shall be provided to the higher standard.

1.2.5. The provisions of the Contract Documents shall govern over any standard specification, manual or code of any technical society, organization, or association. Unless otherwise provided in the Contract Documents, words with an accepted technical or trade meaning used to describe any Work shall be interpreted in accordance with that meaning.

1.2.6. If any Work indicated in, or required by, the Contract Documents is above the standards set by any Law applicable to the Work and the Project, the higher standard shall govern.

1.2.7. The terms "the Contract Documents," "as specified in the Contract Documents," "in accordance with the Contract Documents" or such other similar terms shall be construed as including all valid Change Orders and Change Authorizations.

1.2.8. "Execution of the Work" and "shall provide" includes the furnishing and/or performance of the Work. "*Work*" as in "Unit Price Work," or "any Work" or "acceptable Work," etc. refers to a specific part(s) of the Work.

1.2.9. Subject to the **Contractor's** continuing responsibilities for the acts of Subcontractors and Suppliers, whenever in the Contract Documents the term "the **Contractor**" is used concerning any action, obligation, cost, or event, it shall cover, even if not expressly stated, actions or obligations or costs of, or events involving, any Subcontractor, Supplier, or anyone for whom any of them may be liable, unless the context requires otherwise.

1.2.10. Use of the terms "as ordered," "as directed," "as required," "as allowed," "as approved" or similar terms, or the adjectives "reasonable," "suitable," "acceptable," "proper" or "satisfactory" or similar adjectives, to describe a requirement, direction, review, or judgment of the **Professional** or **Owner** as to the Work will be solely to evaluate the Work for compliance with the Contract Documents. No use of any such term or adjective, or provision of any standard specification, manual or code (whether expressly incorporated by reference in the Contract Documents or not), or Suppliers' instructions, shall be effective to (a) change the duties and responsibilities of the **Owner** or **Professional** from those assigned in the Contract Documents, (b) assign to the **Owner** or **Professional** any duty or authority to supervise or direct the furnishing or performance of the Work or assume responsibility contrary to the provisions of the Contract Documents.

1.2.11. A provision stating "the **Contractor** shall bear its proportionate share of the Delay and costs" shall be construed as entitling the **Owner** to an appropriate decrease in Contract Price and Contract Time for all the **Owner's** direct, indirect, and consequential costs and damages that are attributable to the **Contractor**.

1.2.12. Contract Time computations shall be made in Calendar Days. The Progress Schedule shall be in the form of a Critical Path Method schedule, Total Float and Contract Float values stated in Business Days shall be converted to Calendar Days when used for the purpose of calculating changes in Contract Time.

1.2.13. Any computation of a Contract Time which adds Calendar Days to a date shall include both the first and last Day. Any computation of a notice period shall exclude the first Day and include the last Day. In any case, if the computed Day falls on a non-Business Day, it shall be omitted from the computation.

1.2.14. In the Contract Documents, the terms "substantially completed" and "substantially complete" have in context the same meaning as Substantial Completion.

### 1.3 Priority of the Contract Documents:

1.3.1. Whenever an issue of priority involves two Sections within the Contract Documents, the following will apply: Unless the **Owner** and **Contractor** mutually agree otherwise, a Section of the Contract Documents will *supersede* another *conflicting* Section if the *superseding* Section is listed in paragraph 2.2 of Section 00500 Agreement ahead of the *conflicting* Section.

1.3.2. Whenever an issue of priority involves Work called for in the technical Specifications or Drawings – figured dimensions shall govern scaled dimensions, detail Drawings shall govern general Drawings and Drawings shall govern Submittals. Whenever specifications, dimensions, notes, schedules, or details conflict (whether within the Specifications or Drawings, or between the Specifications and Drawings, or between Change Order Drawings and the Drawings), the **Contractor** shall be required to provide the higher performance requirement only to the extent such outcome results in Work reasonably inferable.

### 1.4 Interpretation of Indemnification Provisions:

1.4.1. Paragraphs 1.4.2 and 1.4.3 will be as effective as if repeated in paragraphs 4.5.2, 4.6.1, 4.9.1, 10.4.4, 13.3.1 and in any other paragraph requiring the **Contractor** to defend, indemnify and hold harmless the **Owner** and **Professional**.

1.4.2. Any indemnification provision requiring the **Contractor** to defend, indemnify and hold harmless the **Owner** and **Professional** against all claims, or covering liability of the **Owner** or **Professional**, shall include claims caused in part by the negligence or other liability-creating conduct or omission of the **Contractor**.

1.4.3. The terms "against all claims" in any such obligation shall be construed as covering all claims, of whatever type and nature, and all judgments, costs, losses, and damages, whether direct, indirect, or consequential (including, but not limited to, charges of architects, engineers, attorneys and others and all court, hearing, and any other dispute resolution costs).

### 1.5 Additional Interpretations:

1.5.1. The term "the **Professional**" shall be construed as covering, even if not expressly stated, the **Professional's** consultants, agents, and employees. This interpretation shall not be construed as relieving the **Professional** of its sole responsibility for the performance of the **Professional's** obligations and responsibilities, whether performed by the **Professional** directly or through any consultant, agent, or employee.

1.5.2. The expression "any act or omission within the control of" shall include, but is not limited to, the fault or negligence of the party involved and any other act, cause, and event for which that party is responsible. The expression "any cause beyond the control of" shall include any act or omission not within the reasonable control of the party involved and any other act, cause, and event for which that party is not responsible.

1.5.3. Whenever in the Contract Documents, the term "first tier" is used concerning a Subcontractor or Supplier, it means a Subcontractor or Supplier having a direct Sub agreement with the **Contractor**. Relatedly, the term "lower tier" refers to a Subcontractor or Supplier having a direct Sub agreement with another Subcontractor.

1.5.4. The expression "materials and/or equipment" shall not be construed to equate materials with equipment, but rather shall be interpreted as a general reference to materials or equipment, whichever actually applies. The term "stored materials" shall include materials and equipment. Where a differentiation between materials or equipment is necessary, such as for payments for approved equipment Shop Drawings, use of the term "equipment" shall exclude materials. In any such case, examples of equipment shall be conveying equipment, tanks, pumps, vessels, fans, boilers, air handling units, heat exchangers, compressors, incineration equipment, motor control centers, switchgears, transformers, control panels and so forth; and such components as pipe fittings and specialties, valves, ductwork, plumbing fixtures, cable tray, conduit and cable, electrical fixtures, panel boards and so forth shall be materials and not equipment.

1.5.5. The term "registered mail" includes registered U.S. mail and certified U.S. mail with return receipt requested. The term "hand delivered" includes delivery by private carriers.

1.5.6. The term "self-performed Work" means Work performed by the **Contractor**, as opposed to Work performed by a Subcontractor, which is referred to as "Subcontractor Work."

1.5.7. An "early completion" Progress Schedule is a **Contractor**-prepared Revision Progress Schedule Submittal that anticipates completion of the entire Work, or of any portion of the Work having a separate, specified Contract Time, ahead of the correspondingly specified Contract Time.

## 1.6 Ownership and Use of the Contract Documents:

1.6.1. Neither the **Contractor** nor any Subcontractor or Supplier shall have or acquire title to or ownership rights in any of the Drawings, Specifications or documents identified in Section 00210 Information for Bidders, and they shall not reuse any of them on extensions of the Project or any other project without prior written consent of the **Owner** and **Professional**.

1.6.2. The **Contractor**, Subcontractors and Suppliers are granted a limited license to use and reproduce parts of the Contract Documents and those documents identified in Section 00210 Information for Bidders as appropriate for their use in the furnishing and performance of their Work. All copies of the Drawings and Project Manual and other documents made under this license shall retain all copyright and trademark notices, if any.

## 1.7 Copies of the Contract Documents:

1.7.1. The **Owner** will furnish, at no cost to the **Contractor**, one (1) electronic copy of the Drawings and Project Manual. If the **Contractor**, or the Contractor's Subcontractors or Suppliers request hard copy sets, reproduction of these documents will be the responsibility of the **Contractor**.

## ARTICLE 2 THE OWNER – GENERAL PROVISIONS

### 2.1 Availability of Lands, Areas, Properties and Facilities:

2.1.1. The Contract Documents indicate the lands, areas, properties, and facilities upon which the Work is to be performed and those rights-of-way and easements for access to the site furnished by the **Owner**. Easements for permanent structures or for permanent changes in any existing lands, areas, properties, and facilities will be obtained by the **Owner**, unless otherwise expressly stated elsewhere in the Contract Documents.

2.1.2. The **Contractor** shall obtain, at no increase in Contract Price or Contract Time, any other lands, areas, properties, facilities, rights-of-way, and easements the **Contractor** requires for temporary facilities, storage, disposal of spoil or waste material or any other such purpose. If public property, the **Contractor** shall obtain all required permits from the federal agency, State agency, Political Subdivision or Public Utility with jurisdiction. If private property, the **Contractor** shall obtain prior permission by written agreement. The **Contractor** shall submit copies of the permits and written agreements to the **Owner**.

### 2.2 Reference Points; Base Lines and Benchmarks:

2.2.1. Unless noted otherwise, the **Owner** or **Professional** will provide engineering surveys to establish reference points for

construction that the **Professional** considers necessary for the **Contractor** to proceed with the Work. The **Contractor** shall be responsible for surveying and laying out the Work from those reference points. The **Contractor** shall be responsible for protecting and preserving those reference points as well as any base lines and benchmarks provided for the Work.

2.2.2. The **Contractor** shall make no changes on any reference points, base lines, and benchmarks without the **Professional's** prior written approval. The **Contractor** shall report to the **Professional** whenever any reference point, base line or benchmark is lost, destroyed, or requires relocation. The **Contractor** shall replace and relocate any lost or destroyed reference points accurately, with professionally, licensed personnel, if so, directed by the **Professional**.

2.2.3. The **Contractor** shall bear its proportionate share of the Delay and costs resulting from any loss, destruction, replacement and/or relocation of reference points, base lines and/or benchmarks, to the extent any such loss, destruction, replacement and/or relocation results in whole or in part from any act or omission within the control of the **Contractor**.

### 2.3 Stop Work Order:

2.3.1. The **Owner** may order the **Contractor** in writing to stop the Work, in the whole or in part, in the event any of these situations occur: (a) any Work is Defective, (b) any Work, when completed, will not conform to the Contract Documents, (c) any materials or equipment are unsuitable, or (d) any workers are insufficiently skilled. The **Contractor** shall bear its proportionate share of the Delay and costs resulting from any such stop Work order unless the **Contractor** is/was not at fault.

2.3.2. If the **Contractor** is/was not at fault, the **Owner** will amend the Contract Documents to provide for any adjustments in Contract Price and/or Contract Time made necessary by any resulting Delay which is unreasonable under the circumstances. This authority to stop the Work or any Work shall not create or impose any duty or responsibility on the **Owner** to exercise such authority for the benefit of the **Contractor** or of any Subcontractor, Supplier, surety to any of them or any other third party.

### 2.4 Limitations on the Owner's Responsibilities:

2.4.1. The **Owner** is not responsible for the **Contractor's** Means and Methods, safety precautions and programs related to safety, or the **Contractor's** failure to execute the Work in accordance with the Contract Documents. Nor is the **Owner** responsible for any act or omission of the **Contractor** or of any Subcontractor, any Supplier or anyone for whose acts the **Contractor** or any Subcontractor or Supplier may be liable.

2.4.2. The **Owner** is not responsible for verifying whether the **Contractor's** Progress Schedule Submittals, any certificates and/or policies of insurance or any technical Submittals are in accordance with the Contract Documents, or for verifying their accuracy or completeness in any way.

2.4.3. Neither the **Owner's** authority to review any of those Submittals, nor the **Owner's** decision to raise or not raise any objections about any such Submittals, shall create or impose any duty or responsibility on the **Owner** to exercise any such authority or decision for the benefit of the **Contractor**, any Subcontractor or Supplier, any surety to any of them or any other third party.

## 2.5 Additional General Provisions:

2.5.1. Written communications from the **Owner** to the **Contractor** will generally be issued through the **Professional**. If there is need to issue communications directly, a copy will be sent concurrently to the **Professional**. Written communications from the **Contractor** to the **Owner** may be issued directly to the **Owner** or through the **Professional** if such is more appropriate. Any such communication shall also include concurrent copy of both parties.

2.5.2. The **State Facilities Administration** Representative shall be the representative for the **Owner**. The **State Facilities Administration** Representative may be represented on-site by a Field Representative(s). Neither the **State Facilities Administration** Representative nor the Field Representative shall have authority to interpret the requirements of the Contract Documents. Unless delegated by specific written notice from the **Owner**, the Field Representative does not have any authority to order any changes in the Work or authorize any adjustments in Contract Price or Contract Time.

## 2.6 Partnering Charter:

2.6.1. If the Contract Documents indicate the **Owner's** intent to implement a bilateral partnering charter, unless the **Contractor** declines in writing, the **Contractor** shall cooperate with the **Owner** in implementing such a partnering charter for the Contract. Unless the possibility is expressly allowed for in the Contract Documents, no provision, requirement, or other aspect of the Contract Documents shall be open for change, revision, or modification in any such partnering charter.

## ARTICLE 3 THE PROFESSIONAL – GENERAL PROVISIONS

### 3.1 Owner's Representative:

3.1.1. The **Professional** shall be the **Owner's** representative during the Contract Time period. The **Professional's** duties, responsibilities and limits of authority set forth in the Contract Documents shall not be changed without the prior written consent of both the **Owner** and **Professional**.

3.1.2. The **Professional** will make On-Site Inspections at intervals appropriate to the stages of the Work to observe the quality and quantity of progress and completed Work; to determine actual quantities of Unit Price Work completed by the **Contractor** and to determine whether the Work is being executed so that the Work, when completed, will be in accordance with the Contract Documents. Based on the On-site Inspections, the **Professional** will endeavor to guard the **Owner** from Defective Work and to keep the **Owner** informed of the progress of the Work.

3.1.3. If the **Professional** assigns Resident Project Representatives, their duties, responsibilities, and limits of authority will be given in the Contract Documents or at the pre-construction conference. Unless delegated by specific written notice from the **Owner**, the Resident Project Representative does not have any authority to order any changes in the Work or authorize any adjustments in Contract Price or Contract Time.

3.1.4. The **Professional** will have authority to disapprove or reject Work that the **Professional** believes to be Defective, and to require inspection or testing of any Work, whether or not such Work

is fabricated, installed, or completed. The **Contractor** shall take prompt corrective action upon receiving any Defective Work notice from the **Professional**.

3.1.5. On-Site Inspections by the **Professional** and/or Resident Project Representatives shall not create or impose any duty on the **Professional** or Resident Project Representatives to make the On-Site Inspections for the benefit of the **Contractor** or any other third party. On-Site Inspections will not relieve the **Contractor** from its obligation to provide the Work in accordance with the Contract Documents or represent acceptance of Defective Work.

3.1.6. Inspections by the Field Representative(s) shall not create or impose any duty on such Field Representative to make the observations for the benefit of the **Contractor** or any other third party. Any such inspection will not relieve the **Contractor** from its obligation to provide the Work in accordance with the Contract Documents or represent acceptance of Defective Work.

### 3.2 Clarifications and Interpretations:

3.2.1. The **Professional** will issue with reasonable promptness written clarifications or interpretations as the **Professional** may determine necessary or in response to a **Contractor** written request for interpretation. If the **Contractor** believes that a written clarification or interpretation issued by the **Professional** justifies an adjustment in Contract Price or Contract Time, the **Contractor** shall promptly notify the **Professional** in writing before proceeding with the Work Involved.

3.2.2. In any such case, if the **Contractor** is properly authorized in writing to proceed with the Work Involved before full agreement is reached on the extent of any such adjustments (if any are determined to be due at all), the **Contractor** shall furnish to the **Professional**, upon request from the **Professional**, those actual cost Records specified in paragraphs 11.4 and 11.5.

### 3.3 Minor Variations and No-Cost Changes; Minor Delays:

3.3.1. The **Professional** may authorize minor variations in the Work, order no-cost changes consistent with the Contract Documents or cause minor Delay if, in the **Professional's** judgment, such variation, no-cost change or Delay does not justify any adjustment in Contract Price or Contract Time. Minor variations will be ordered in writing; no-cost changes will be authorized by Change Authorization. If the **Contractor** believes any minor variation or no-cost change justifies an increase in Contract Price or Contract Time, the **Contractor** shall promptly notify the **Professional** in writing before proceeding with the Work Involved and follow the procedures in paragraph 3.2. Notice requirements for minor Delays are provided in paragraph 8.7.4.

### 3.4 Determinations by the Professional:

3.4.1. The **Professional** will be the interpreter of the requirements of the Contract Documents and, in such capacity, will render determinations on the acceptability of the Work. Notices, proposals, claims, or other matters relating to the acceptability of the Work, the interpretation of the requirements of the Contract Documents or any adjustment in Contract Price or Contract Time shall be referred to the **Professional** in writing requesting a formal, written determination, which the **Professional** will render within a reasonable time. If the **Contractor** disagrees with any such



**Professional** determination, the **Contractor** may deliver notice of a claim and a claim submittal within thirty (30) Calendar Days in accordance with the procedures and within the deadlines set forth in Article 15 Disputes.

3.4.2. The rendering of any interpretation or of any determination on any notice, proposal, claim, or other matter relating to the acceptability of the Work or to any adjustment in Contract Price or Contract Time will be a prerequisite to the exercise by the **Contractor** of any rights or remedies the **Contractor** may otherwise have under the Contract Documents or by Law concerning any such issue.

### 3.5 Limitations on the Professional's Responsibilities:

3.5.1. The **Professional's** authority to act under this Article 3 or elsewhere in the Contract Documents, or any decision made by the **Professional** in good faith to exercise or not to exercise such authority, shall not give rise to any duty or responsibility of the **Professional** to the **Contractor**, to any Subcontractor or any Supplier, to any surety or to any third party.

3.5.2. The **Professional** is not responsible for the **Contractor's** Means and Methods, safety precautions and programs related to safety, or for the **Contractor's** failure to execute the Work in accordance with the Contract Documents. Furthermore, the **Professional** is not responsible for any act or omission of the **Contractor** or of any Subcontractor, Supplier, or anyone for whose acts the **Contractor** or any Subcontractor or Supplier may be liable.

## ARTICLE 4 CONTROL OF WORK – GENERAL PROVISIONS

### 4.1 Review of the Contract Documents:

4.1.1. Before undertaking each part of the Work, the **Contractor** shall study and compare the Contract Documents with each other and against manufacturers' recommendations for installation and handling. Before undertaking each part of the Work, the **Contractor** shall verify dimensions and take field measurements, and the **Contractor** shall coordinate the location, dimensions, access, fit, completeness, etc. of dependent Work. The **Contractor** shall promptly notify the **Professional** in writing of any conflict, error or omission in the Contract Documents and deviation from manufacturers' recommendations for installation and handling discovered.

4.1.2. The **Contractor** shall bear its proportionate share of the Delay and costs resulting from any Work undertaken before apprising the **Professional** and/or obtaining a written clarification or interpretation from the **Professional**, if the **Contractor** knows or has reason to know that any such Work (a) involves a conflict, error or omission, or (b) is subject to a specified Means and Method which is inappropriate, unworkable or unsafe, or (c) is subject to a specified method of installation, performance or test procedure and/or result which is contrary to the recommendations provided by or for the respective manufacturer.

### 4.2 Management, Supervision and Personnel:

4.2.1. The **Contractor** shall manage, supervise, and direct the Work competently, applying the management, supervision, skills, expertise, scheduling, coordination, and attention necessary to provide the Work in accordance with the Contract Documents, while insuring timely and unhindered access to the site. The **Contractor** shall be responsible for any Means and Methods unless a specific

Means and Method is indicated in or required by the Contract Documents. The **Contractor** shall verify that completed Work complies with the Contract Documents, all approved Submittals and all clarifications and interpretations.

4.2.2. The **Contractor** shall maintain a competent, full-time superintendent on the Work at all times during its progress. The superintendent shall be the **Contractor's** representative at the site and shall have authority to act on behalf of the **Contractor**. The Superintendent shall not be assigned or replaced without the **Owner's** consent. If the **Owner**, in the reasonable exercise of its discretion, objects to the superintendent, the **Contractor** shall use a replacement superintendent at no increase in Contract Price or Contract Time. All communications given to the superintendent shall be as binding as if given to the **Contractor**.

4.2.3. The **Contractor** shall provide competent, suitably qualified personnel to survey and lay out the Work. As part of this responsibility, the **Contractor** shall engage a registered land surveyor to accurately locate base lines and Project elevations. The **Contractor** shall be required to furnish certifications that lines and grades for all concrete slabs were checked before and after placing of concrete, and that final grades are as required by the Contract Documents.

4.2.4. The **Contractor** shall provide competent and suitably qualified trade foremen and craft workers to construct the Work, in all cases as required by the Contract Documents. At all times, the **Contractor** shall maintain good discipline and order at the site.

4.2.5. Whenever activities of the **Contractor** are carried out beyond the limits of the site or the indications of temporary fences or barricades, the **Contractor** shall schedule trenching, utility Work, site development, landscaping and all other activities in the way that will cause minimum disturbance to or interference with adjoining property, service to the public or the normal operation of the **Owner** or others affected by such activities.

4.2.6. If a Means and Method is indicated in, or required by, the Contract Documents, a substitute Means, and Method may be used by the **Contractor** only after obtaining the **Professional's** approval that it meets the applicable criteria in paragraph 5.2 without increasing Contract Price or Contract Time. If any such substitution causes earlier completion of the Work, the **Owner** and **Contractor** may negotiate an appropriate shortening in Contract Time, a level of liquidated damages appropriate to the shortened Contract Time, and a decrease in the Contract Price. If the **Owner** and **Contractor** are unable to agree on the extent of any such adjustments, the **Owner** may deliver a claim in accordance with the procedures and within the deadlines set forth in Article 15.

4.2.7. The **Contractor** shall post appropriate construction signs to advise the occupants and visitors of occupied facilities of the limits of construction work areas, hardhat areas, excavations, construction parking and staging areas, etc.

### 4.3 Materials and Equipment:

4.3.1. Unless otherwise specified in the Contract Documents, the **Contractor** shall furnish and be responsible for all materials, equipment, transportation, construction equipment, tools, supplies, fuel, utilities, water for flushing and testing, temporary facilities and all other facilities and incidentals necessary for the furnishing and performance, which includes, without limitation, the testing and completion of the Work.

4.3.2. All materials and equipment shall be of good quality, free of defect and new, unless otherwise allowed in the Contract Documents. For each material and equipment, the **Contractor** shall provide complete information on preventive maintenance, operating requirements, parts lists, ordering of parts and other applicable conditions. Materials and equipment shall be protected against any damage at all times so that they remain new.

4.3.3. If required for the **Professional's** acceptance of any materials or equipment, the **Contractor** shall furnish satisfactory evidence (which shall include test procedures and reports of required tests) as to the kind and quality of the materials and equipment. Materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned following the manufacturer's and Suppliers' instructions, except as otherwise provided in the Contract Documents.

4.3.4. Paragraph 7.3, Section 00100 Instructions to Bidders, dealing with materials and equipment *listed* in Schedule 1.6 of Section 00440 Schedule of Materials and Equipment is made part of this Section 00700 General Conditions by this reference.

#### 4.4 Concerning Control of Work:

4.4.1. The **Contractor** shall prosecute the Work in the way that will cause the least practicable interference with and avoid prolonged interruption of, or damage to, existing facilities. The **Contractor** shall obtain written approval from the **Owner** ten (10) Calendar Days before connecting to existing facilities or interrupting service. If the **Contractor's** Means and Methods require tapping into an existing system(s), the **Contractor** shall be responsible for the restoration of such system and of any extensions of such systems.

4.4.2. To the extent specified Work on an existing system may cause damage to, or imbalances in extensions of such systems, and restoration of the entirety of such systems is not designated in the Drawings and/or Specifications as required Work, the **Contractor** shall be responsible for seeking an appropriate clarification or interpretation from the **Professional** before proceeding with the Work Involved.

4.4.3. The **Contractor** shall perform Work and operate vehicles and construction equipment in a safe manner and without becoming a hazard to the public, while at the same time ensuring the least practicable interference with pedestrians and traffic. In addition, such operations shall be carried out without interfering with overhead utilities. When transporting materials or equipment, vehicles shall not be loaded beyond the capacity set by their manufacturers or applicable Laws. When crossing sidewalks, curbs or landscaped areas, the **Contractor** shall protect them from damage. Safe and adequate pedestrian and vehicular access shall be maintained to fire hydrants, commercial and industrial establishments, churches, schools, parking lots, hospitals, fire, and police stations and like establishments.

4.4.4. The **Contractor** shall be responsible for performing the pumping, draining, and controlling of surface water and groundwater in the way that will not endanger the Work or any adjacent facility or property, or interrupt, restrict or interfere with the use of any adjacent facility or property.

4.4.5. Paragraph 3.10, Section 00100 Instructions to Bidders, invoking the "Soil Erosion and Sedimentation Control," 1994 PA 451, Part 91, as amended, MCL 324.9101 et seq., is made part of Section 00700 General Conditions by this reference.

4.4.6. To the extent the **Contractor** knows, or has reason to know, the **Contractor** shall be responsible for performing the Work taking fully into account any dewatering, blasting, etc. operations from other work bearing a potential impact on the Work.

4.4.7. Any damaged Work corrected by the **Contractor** shall be corrected and made equal in all respects (quality, finish, appearance, function, etc.) to similar non-damaged Work otherwise required by the Contract Documents.

4.4.8. The **Contractor** shall verify that Work already *in-place* is in proper condition to receive *dependent* Work, and that dependent Work connecting to the *in-place* Work is properly coordinated. Whether or not expressly specified in the Contract Documents, the **Contractor** shall be responsible for all cutting, fitting, drilling, fixing-up and patching of concrete, masonry, gypsum board, piping and other materials that may be necessary to make *in-place* Work and *dependent* Work fit together properly.

4.4.9. The **Contractor** shall not obstruct access to municipal structures, hydrants, valves, manholes, fire alarms, etc., nor operate valves or otherwise interfere with the operation of any Public utilities without first securing the necessary approvals and permits. Except as may be otherwise provided in the technical Specifications, the **Owner** will charge the **Contractor** for all utilities used based on the charges the **Owner** actually incurs.

4.4.10. In the event of any unauthorized interruption of service to any operating facility, the **Contractor** shall take immediate action to restore that service as soon as practicable. The **Contractor** shall be directly responsible for the charges of any manufacturer's representative called to the site to repair or adjust any systems damaged by the **Contractor**.

4.4.11. Whenever the **Contractor** has caused an operating security system to go out of service or left unsecured openings in existing facilities or security fences, the **Contractor** shall furnish a security guard acceptable to the **Owner** to maintain security of the facility outside of normal working hours. The **Contractor** will be held responsible for any losses on account of the **Contractor's** interruption of security systems or barriers at existing facilities.

4.4.12. The **Contractor** shall take steps, procedures or means as may be required to prevent dust nuisance resulting from the **Contractor's** operations. The dust control measures shall be maintained at all times to the satisfaction of the **Owner** and any Political Subdivision with jurisdiction.

4.4.13. The **Contractor** shall, before final inspection, mark in a permanent and readily identifiable manner, all reference points provided by the **Owner**.

#### 4.5 Patent Fees and Royalties:

4.5.1. The **Contractor** shall be responsible for paying all royalties and license fees and assuming all costs resulting from the use in the furnishing and performance of the Work and/or the incorporation into the Work of any invention, design, process, product, or device covered by patent rights or copyrights, whether specified in the Contract Documents or chosen by the **Contractor**.

The **Contractor** shall sign suitable agreement(s) with the patentee or copyright owner and, if requested, provide copies to the **Owner**.

4.5.2. The **Contractor** shall defend, indemnify, and hold harmless the **Owner** and **Professional** from and against all claims, as construed in paragraph 1.4, arising from any patent or copyright infringement by the Contractor including, but not limited to, patent or copyright infringements resulting from "or equal" substitution of any invention, design, process, product, or device that is specified in the Contract Documents.

4.5.3. If the **Contractor** knows, or should know, that the specified invention, design, process, product, or device infringes on a patent or copyright, the **Contractor's** obligation to defend, indemnify and hold harmless **Owner** and **Professional** from and against all claims arising from any patent or copyright infringement shall apply, unless the **Contractor** promptly furnishes that information to the **Professional** in writing.

#### 4.6 Use of Premises:

4.6.1. The **Contractor** shall confine its operations (including, but not limited to construction equipment and laydown and storage) to the site and lands, areas, properties, facilities, rights-of-way, and easements ("the premises") identified and permitted by the Contract Documents and shall not unreasonably encumber the premises. The **Contractor** shall be responsible for any damage to the premises (including, but not limited to, damage to any real and personal property) and for any damage to any adjacent lands, areas, properties, facilities, rights-of-way, and easements (including, but not limited to, damage to any real and personal property) resulting from the **Contractor's** operations. The **Contractor** shall defend, indemnify, and hold harmless the **Owner** and **Professional** against all claims, as construed in paragraph 1.4, arising from any damage to such premises or adjacent lands, areas, properties, facilities, rights-of-way, and easements (inclusive of real and personal property), including loss of use, to the extent resulting from the **Contractor's** operations.

4.6.2. The **Contractor** shall keep the premises free from accumulations of waste materials, rubbish, and other debris, and shall not remove, injure, cut, alter, or destroy trees, shrubs, plants, or grass, unless otherwise provided elsewhere in the Contract Documents. At the completion of the Work, the **Contractor** shall remove all obstructions, waste and surplus materials, rubbish, debris, tools, and construction equipment and shall leave the site clean and ready for occupancy by the **Owner**.

4.6.3. The **Contractor** shall restore to pre-existing conditions all walks, roadways, paved or landscaped areas and other real and personal property not designated for alteration by the Contract Documents. To the extent the **Contractor** refuses, fails or neglects to replace all such altered premises and/or restore to its pre-existing condition any walk, roadway, paved or landscaped area and other property not designated for alteration by the Contract Documents, the **Contractor** shall bear its proportionate share of the Delay and costs resulting from the **Contractor's** refusal, failure, or neglect to do so.

4.6.4. The **Contractor** shall not load or permit any part of any structure to be loaded in any way that will endanger the structure. The **Contractor** shall not subject any part of the Work or adjacent property to stresses or pressures that will damage or endanger the Work or adjacent property, or both.

#### 4.7 Record Documents:

4.7.1. The **Contractor** shall maintain at the site one copy of all Record Documents in good order and annotated in a neat and legible manner using a contrasting, reproducible color to show (a) all revisions made, (b) dimensions noted during the furnishing and performance of the Work, and (c) all deviations between the as-built installation and the Contract Documents, all approved Submittals and all clarifications and interpretations.

4.7.2. Record Documents, along with a properly annotated copy of all approved Submittals, shall be available to the **Professional** and **Owner** at all times during the progress of the Work. The finalized Record Documents and approved Submittals shall be required for processing final payment to the **Contractor**.

4.7.3. The **Contractor** shall maintain and make available to the **Owner** and **Professional** daily field reports and digital photos recording the on-site labor force and equipment (**Contractor** and Subcontractors); materials/equipment received (at the site or at another location); visits by Suppliers; significant in-progress and completed trade Work within major areas; and other pertinent information.

4.7.4. Such daily field reports shall be furnished by the **Contractor** promptly to the **Professional** and **Owner** upon their request and shall be accepted by the **Owner** for information only. Neither the **Owner** nor **Professional's** review of any daily field report shall be construed as agreement with the information contained in any such daily field report.

#### 4.8 Emergencies:

4.8.1. In Emergencies affecting the safety or protection of Persons, the Work or property at or adjacent to the site, the **Contractor**, without any special instruction or authorization from the **Professional** and/or the **Owner**, is obligated to act to prevent threatened damage, death, injury, or loss.

4.8.2. The **Contractor** shall give the **Owner** prompt written notice of any changes in the Work resulting from the action taken. If the **Owner** concurs, the **Owner** will amend the Contract Documents to provide for those changes and, unless the Emergency results in whole or in part from any act or omission within the control of the **Contractor**, to provide for any corresponding adjustment in Contract Price and/or Contract Time.

#### 4.9 Indemnification:

4.9.1. The **Contractor** shall defend, indemnify and hold harmless the **Owner** and **Professional** from and against all claims, as construed in paragraph 1.4, for bodily injury, sickness, disease or death, or injury to the destruction of property, including loss of use, arising out of, relating to, or being in any way connected with the Work, that are in any way (a) caused by any negligent act or omission of the **Contractor**, any Subcontractor or Supplier or anyone for whose acts any of them may be liable, or (b) related to the **Contractor's** failure to maintain the required insurance and coverages. As a point of emphasis, and as set forth in paragraph 1.4, such claims shall include, but are not limited to charges of architects, engineers, attorneys and others and all court, hearing, and other dispute resolution costs.

4.9.2. As a point of emphasis, as set forth in paragraph 1.4, this indemnification obligation shall include claims caused in part by

the negligence or other liability-creating conduct or omissions of the **Owner** (including State departments, agencies, boards, commissions, officers, and employees) or **Professional**; however, the **Contractor** shall not be required to indemnify the **Owner** or **Professional** against liability for loss or damage resulting from the sole negligence of the **Owner** and/or **Professional**.

4.9.3. With respect to claims against the **Owner** or **Professional** by any employee of the **Contractor**, the indemnification obligation under this paragraph 4.9 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the **Contractor**, any Subcontractor or Supplier under workers' compensation, disability benefit or other benefit acts.

## ARTICLE 5 SUBCONTRACTORS AND SUPPLIERS

### 5.1 Employment of Subcontractors:

5.1.1. Upon due investigation, the **Owner** may revoke, because of subsequent violation of a material requirement of the Contract Documents, the **Owner's** consent to any Subcontractor previously given pursuant to the provisions of Article 8 of Section 00100 Instructions to Bidders and Section 00430 List of Subcontractors. Any such revocation of the **Owner's** consent shall not justify any increase in Contract Price or Contract Time.

5.1.2. After Contract Award, if the **Contractor** intends to add or substitute a Subcontractor for Work in a Division, Specification and/or trade for which Subcontractor nomination was required in Section 00430 List of Subcontractors, the **Contractor** shall nominate that Subcontractor for review by the **Owner** and/or **Professional**. The **Contractor** shall not award such Work to any Subcontractor to whom the **Owner** objects for good cause. No adjustment in Contract Price or Contract Time shall be allowed for any such newly nominated Subcontractor.

5.1.3. Whenever the **Owner** objects, for its convenience, to any Subcontractor nominated, but not objected to, before Contract Award or to any Subcontractor nominated after Contract Award, the **Contractor** shall nominate a substitute Subcontractor or shall proceed to self-perform the Work involved if the **Contractor** is so qualified. If any such **Owner** objection requires a Subcontractor substitution or the **Contractor** to self-perform the Work Involved, in either case at an increase of the **Contractor's** cost for the part of the Work Involved, the **Owner** will amend the Contract Documents to provide for a corresponding adjustment in Contract Price and/or Contract Time made necessary by the Subcontractor substitution or self-performance and by any resulting Delay which is not reasonably anticipatable under the circumstances and which is attributable to the **Owner** and/or **Professional**.

5.1.4. Failure of the **Owner** to object to any nominated Subcontractor shall not constitute a waiver of any right of the **Owner** or **Professional** to reject Defective Work; nor shall the authority given to the **Owner** under this paragraph create or impose any duty on the **Owner** or **Professional** to exercise such authority for the benefit of the **Contractor** or any other third party.

5.1.5. Installation of any self-performed or Subcontractor Work shall constitute acceptance by the **Contractor** of all previously placed dependent Work. Consistent with this responsibility, the **Contractor**, directly or through the **Contractor's** choice of Subcontractors, shall supply, install and/or cause items to be built into previously placed Work, shall verify dimensions of previously

placed Work, and shall notify the **Professional** of previously placed Work that is unsatisfactory for, or prevents satisfactory installation of, other dependent Work.

5.1.6 Work performed by any Subcontractor or Supplier shall be through an appropriate written Sub agreement that expressly binds the Subcontractor or Supplier to the requirements of the Contract Documents and contains the waiver of rights of subrogation provisions of Article 7.

### 5.2 "Or Equal" and Substitute Materials and Equipment:

5.2.1. Materials or equipment described in the Contract Documents by using a brand name, make, manufacturer, supplier, or specification shall be intended to denote the essential characteristics desired and establish a standard.

5.2.2. For materials and equipment which are actually *listed* in Schedule 1.6 of Section 00440 Schedule of Materials and Equipment, no "or equal" or substitute material or equipment will be acceptable or permitted unless the **Contractor** complies with the terms and conditions of paragraphs 5.2.2.1 through 5.2.2.5.

5.2.2.1. Unless words are used in a technical Specification indicating that no "or equal" or substitution is permitted, a proposal for an "or equal" or substitution may be accepted by the **Professional** if, in the **Professional's** judgment, the proposal (a) meets the criteria set forth in paragraphs 5.2.2.2 through 5.2.2.5, (b) demonstrates a net positive deduction, i.e., the deductive value of the proposal exceeds all direct, indirect and consequential costs and damages attributable to the "or equal" or substitution, and (c) offers a Contract Price decrease of one hundred percent (100%) of the net deduction, or another percentage reflecting a sharing of the savings which is agreed between the **Owner** and **Contractor**.

5.2.2.2. The **Contractor's** written application for the "or equal" or substitute material or equipment shall provide sufficient information to allow the **Professional** to determine whether the material or equipment proposed (a) will equally perform the functions and achieve the results called for by the Contract Documents, (b) is at least of equal materials of construction, quality and necessary essential design features, (c) is suited to the same use as that named or specified, (d) conforms substantially to the desired detailed requirements, e.g., durability, strength, appearance, aesthetics (if aesthetics are significant), safety, useful life, reliability, economy of operation and ease of maintenance, (e) evidences a proven record of performance and the availability of responsive service, and (f) will not extend any Contract Times.

5.2.2.3. Each such application shall certify whether or not acceptance of the proposed "or equal" or substitute material or equipment will require a change in any of the Work or any of the Means and Methods indicated in or required by the Contract Documents, or in work performed by the **Owner** or others, and whether or not incorporation or use of the proposed material or equipment is subject to payment of any license fee or royalty. All variations of the proposed material or equipment from the material or equipment named or specified shall be identified (operation, materials or construction finish, thickness or gauge of material, dimensions, loads, tolerances, deleted and added features, etc.), and information regarding available maintenance, repair and replacement service shall be indicated.

5.2.2.4. The application shall contain an itemized estimate of all direct, indirect, and consequential costs and damages that will

result from evaluation and acceptance of the proposed "or equal" or substitute material and equipment, including but not limited to costs and delays of redesign, or claims of other contractors affected by the proposed item, and changes in operating, maintenance, repair, replacement, or spare part costs. The **Professional** may require the **Contractor** to furnish a manufacturer's performance Bond, an analysis of the effects of the evaluation/acceptance of the "or equal" or substitution on the Progress Schedule, a list of locations of similar installations that have been in service for at least three (3) years before the date of the application, and any other relevant data.

5.2.2.5. The **Contractor** shall be responsible for verifying that "or equal" or substitute materials and equipment conform to the Contract Documents, and that all dimensions, arrangement, design and construction details and other features are suited to the specified purpose. If any "or equal" or substitute material or equipment differs materially from the material or equipment named or specified, and that difference was not expressly identified in the **Contractor's** application, or results in changes in the Work, the **Professional** has authority to require removal and replacement of that "or equal" or substitute material or equipment. The **Contractor** shall bear its proportionate share of the Delay and costs resulting from (a) any such removal and replacement of "or equal" or substitute materials or equipment, (b) making "or equal" or substitute materials or equipment conform to the requirements of the Contract Documents, and (c) any changes in the Work and/or in other work required to accommodate the "or equal" or substitute material or equipment, or both.

5.2.2.6. The **Contractor** shall reimburse the **Owner** for any costs incurred by the **Owner** in the evaluation of any "or equal" or substitution proposal. Such costs shall include, but are not limited to, related charges of the **Professional** made necessary by the evaluation and acceptance or rejection, as the case may be, of the proposed "or equal" or substitute material or equipment.

5.2.3. For materials and equipment *not listed* in Schedule 1.6 of Section 00440 Schedule of Materials and Equipment, no substitute material or equipment will be acceptable or permitted unless the **Contractor** meets with the requirements of paragraphs 5.2.2.1 through 5.2.2.5. Further, the reimbursement provisions of paragraph 5.2.2.6 shall apply equally to such substitutions.

5.2.4. Unless approved by the **Professional**, for materials and equipment *not listed* in Schedule 1.6 of Section 00440 Schedule of Materials and Equipment, no "or equal" material or equipment will be acceptable or permitted unless the **Contractor** complies with the requirements of paragraphs 5.2.2.2 – 5.2.2.5.

5.2.5. No "or equal" or substitute item shall be ordered, installed, or utilized without the **Owner's** prior acceptance. The **Owner's** acceptance shall be evidenced by a signed Change Order or Change Authorization, or if so, specifically designated by the **Professional**, by an approved Shop Drawing or sample.

### 5.3 The Contractor's Continuing Responsibilities:

5.3.1. The **Contractor** shall be fully responsible to the **Owner** and **Professional** for all acts and omissions of Subcontractors and Suppliers, at any tier, to the same extent as the **Contractor** is responsible for the **Contractor's** own acts and omissions. Nothing in the Contract Documents shall create any contractual relationship between the **Owner** or **Professional** and any Subcontractor or Supplier. No provision in Article 12 or in the other Contract Documents shall create or impose any express or implied duty or

obligation on the **Owner** or **Professional** to any Subcontractor or Supplier or the **Contractor's** sureties to pay or to see to the payment of any monies owed to any of them.

## ARTICLE 6 SUBMITTALS

### 6.1 Shop Drawing, Sample and Other Technical Submittals:

6.1.1. After complying with those requirements in paragraphs 6.1.2 through 6.1.5 and the technical Specifications, the **Contractor** shall submit to the **Professional** (a) an electronic file(s) of the drawing(s) compatible with the latest version of AutoCAD of all Shop Drawings required by the Contract Documents and bond copies if requested by the **Owner** or **Professional**; (b) all required samples (whether color or otherwise); and (c) all other technical Submittals (test results, test procedures, safety procedures, O&M manuals, etc.) that are required by the Contract Documents.

6.1.2. Submissions shall be delivered to the **Professional** with due diligence, as delineated in or required by the Progress Schedule, and shall allow reasonable times, per 6.5.1, for the **Professional's** review and turnaround. Each Submittal shall be uniquely identified as the **Professional** and **Contractor** may agree.

6.1.3. Each Submittal shall bear a stamp or specific written indication certifying that the **Contractor** has satisfied the requirements of this Article and the technical Specifications and the **Contractor's** responsibilities for prior review of the submission. In addition, each sample shall have been checked and be accompanied by a certificate guaranteeing that the material sampled complies with the Contract Documents. Unless otherwise allowed by the **Professional**, Submittals without the **Contractor's** indication of approval will be returned without review.

6.1.4. Before each submission, the **Contractor** shall (a) determine and verify all field measurements, quantities, dimensions, instructions for installation and handling of equipment and systems, installation requirements (including location, dimensions, access, fit, completeness, etc.), materials, color, catalog numbers and other similar data as to correctness and completeness, and (b) have reviewed and coordinated that technical Submittal with other technical Submittals and the requirements of the Contract Documents. Technical Submittals of a Subcontractor or Supplier shall be coordinated with those of other Subcontractors or Suppliers (location, dimensions, fit, completeness, consistency, integration, etc.), and so represented in the **Contractor's** stamp or specific written approval before submission to the **Professional**.

6.1.5. With each submission, the **Contractor** shall give the **Professional** specific written notice of each variation from the requirements of the Contract Documents, and the **Contractor** shall cause a specific notation of each variation to be made on that Shop Drawing, sample, or other technical Submittal.

6.1.6. Where a Shop Drawing, sample or other technical Submittal is required by the technical Specifications, any related Work performed by the **Contractor** before the **Professional's** approval of the pertinent technical Submittal will be at the sole expense and responsibility of the **Contractor**.

6.1.7. The **Professional** shall be entitled to rely upon the accuracy or completeness of any designs, calculations or certifications made by licensed or certified professionals attached to a specific technical Submittal, whether or not that stamp, or written certification is required by the Contract Documents

## 6.2 Review and Return of Technical Submittals:

6.2.1. The **Professional's** review of a technical Submittal will be to evaluate whether the items covered by the Submittal, after installation or incorporation into the Work, will conform to the general design intent of the Contract Documents and for compatibility with the design of the completed Work as a functioning whole as indicated in the Contract Documents.

6.2.2. The review of Submittals by the **Professional** shall not be conducted for the purpose of determining the accuracy and completeness of such details as dimensions or quantities shown or indicated on the Submittals, or for substantiating instructions for installation or performance of equipment and systems developed by or for the **Contractor**, the correctness of which shall remain the sole responsibility of the **Contractor**. Further, any such **Professional's** review and approval will not extend to any Means and Methods (except where a specific Mean and Method is indicated in or required by the Contract Documents) or to safety precautions or programs related to safety.

6.2.3. Approval by the **Professional** of a separate item or partial Submittal shall not translate to approval of the assembly in which the item functions or to the approval of related Submittals not yet reviewed and approved by the **Professional**.

## 6.3 Progress Schedule Submittals:

6.3.1. After complying with the appropriate Progress Schedule requirements in the technical Specifications, the **Contractor** shall submit to the **Professional** electronic copies of the Progress Schedule Submittal then due, which shall include both PDF format and active software files with the **Contractor's** specific schedule data. Each Progress Schedule Submittal shall bear the **Contractor's** stamp or written indication of approval as representation to the **Owner** that the **Contractor** has determined or verified all data on that Progress Schedule, and that the **Contractor** and Subcontractors and Suppliers have reviewed and coordinated the sequences in that Progress Schedule with the requirements of the Work. Progress Schedule Submittals are not Contract Documents.

6.3.2. Progress Schedule Submittals are intended to show: (a) the priority and sequencing by which the **Contractor** intends to execute the Work (or Work remaining) to comply with the Contract Times, those sequences of Work indicated in or required by the Contract Documents and any other requirements of the Contract Documents; (b) how the **Contractor** anticipates foreseeable events, site conditions and all other general, local and prevailing conditions that may in any manner affect cost, progress, schedule, performance and furnishing of the Work; (c) how the Means and Methods chosen by the **Contractor** translate into Activities and sequencing; (d) the actual timing and sequencing of completed Work; and (e) if required by the Contract Documents, the allocation of the Contract Price to the Activities.

## 6.4 Review and Return of Progress Schedule Submittals:

6.4.1. The **Owner's** and **Professional's** review of Progress Schedule Revision 0 Submittals may result in comments relating to conformance with (a) the Contract Times, (b) those sequences of Work indicated in or required by the Contract Documents, and (c) any other Contract Document requirements that may have a

significant bearing on the use of Revision 0 Progress Schedule Submittals to resolve issues affecting Contract Price and/or Contract Time. Progress Schedule review comments may also result in the selection of Targets and recording of Target Times.

6.4.2. The review of Progress Schedule Revision Submittals may, in addition to the types of comments outlined in paragraph 6.4.1, result in comments as to whether the **Contractor's** scheduling of Work remaining continues to conform with the Contract Times and those sequences of Work indicated in or required by the Contract Documents. Progress Schedule Revision Submittal review comments may also respond to suggested **Contractor** schedule recovery plans, when and as appropriate, and to **Contractor** requests for extensions in Contract Time.

6.4.3. Progress Schedule reviews shall not impose on the **Owner** or **Professional** any responsibility for verifying whether Work is omitted; Activity durations are reasonable; the adequacy of the level of labor, materials, and construction equipment; the reasonableness of the **Contractor's** chosen Means and Methods; or whether Work sequences and Activity timing are practicable. Even if any comments or objections are noted from the reviews of Progress Schedule Submittals, no such reviews or objections noted shall be effective or construed to create or impose on the **Owner** or **Professional** any responsibility for the timing, planning, scheduling, or execution of the Work or for the correctness of any such Progress Schedule details. The correctness of the Progress Schedule shall remain the sole responsibility of the **Contractor**.

## 6.5 Additional Provisions Concerning Submittals:

6.5.1. Unless otherwise designated in a more specific technical Specification, a Submittal will be returned to the **Contractor** within fifteen (15) to twenty (20) Calendar Days, as designated by the **Professional** in writing. If a Submittal cannot be returned when it comes due, the **Professional** shall give appropriate notice to the **Contractor** of its return date. The **Contractor** shall revise, and correct Submittals returned for revision and resubmittal, and resubmit them to the **Professional** directing specific attention in writing to revisions other than the corrections called for by the **Professional** on previous submissions of the same Submittals.

6.5.2. No review or approval of Submittals shall relieve the **Contractor** of responsibility for the following: (a) variation from the requirements of the Contract Documents, unless the **Contractor** has called attention to each variation, as provided in paragraph 6.1.5, and the **Professional** has given written approval of that variation by a specific notation within or attached to the returned Submittal, (b) compliance with the "or equal" and substitution requirements of paragraph 5.2, (c) errors or omissions in the Submittal, or (d) compliance with the requirements of this Article.

6.5.3. Unless the **Professional** determines that additional resubmissions are reasonable under the circumstances, all costs incurred by the **Owner** made necessary by the **Professional's** review of a Submittal after the first resubmission of that Submittal shall be reimbursed by the **Contractor** to the **Owner**.

6.5.4. All time consumed by the resubmissions and rereviews of a particular Submittal shall constitute time required to furnish that Submittal or shall represent Delays not justifying any increase in Contract Time or Contract Price, or both.

**ARTICLE 7 LEGAL REQUIREMENTS; INSURANCE****7.1 Laws; Permits (Which Include Approvals and Licenses):**

7.1.1. The **Contractor** shall comply with and shall require all Subcontractors and Suppliers to comply with, all applicable Laws. The **Contractor** shall insure that everyone employed on the Work discharge their responsibilities consistent with all Laws.

\*7.1.2. The **Contractor** shall secure from the State Department of Labor and Economic Growth and from all Political Subdivisions with jurisdiction, all construction permits necessary for the commencement, prosecution, and completion of the Work before starting any Work at the site. All fees for securing the permits shall be paid by the **Contractor**, including all inspection costs which may be legally assessed by the Bureau of Construction Codes according to authority granted under 1972 PA 230, as amended, MCL 125.1501 et seq. The time incurred by the **Contractor** in obtaining construction permits shall constitute time required to complete the Work and shall not justify any increases in Contract Time or Contract Price, except to the extent any related Delay is attributable to the fault of the Drawings or Specifications or to revisions to the Drawings and/or Specifications required by the Political Subdivision with jurisdiction.

7.1.3. Unless expressly required by any Laws or permits, neither the **Owner** nor **Professional** shall be responsible for monitoring the **Contractor's** compliance with any Law, the State Construction Code, or any permits. The **Contractor** is not responsible to make certain that the Contract Documents comply with applicable Laws and the State Construction Code; however, if the **Contractor** believes the Contract Documents deviate from the requirements of any Law, the State Construction Code or any permit, the **Contractor** shall give the **Professional** prompt written notice. If the **Contractor** provides any Work knowing or having reason to know such Work conflicts with any Laws, or the State Construction Code or any permits, the **Contractor** shall be responsible for that performance. The **Contractor** shall be proportionately responsible for the time required and the costs involved in complying with the obligations stated in this paragraph.

\*7.1.4. All Work shall be provided in accordance with the State Construction Code and the requirements of paragraph 1.2.4. If the **Contractor** observes that any Contract Document is at variance with any Laws or the State Construction Code in any respect, the **Contractor** shall promptly notify the **Professional** in writing, and any necessary changes shall be accomplished by an appropriate Change Order. The **Contractor** shall pay all charges of Public Utilities for connections to the Work, unless otherwise provided by Cash Allowances specific to those connections.

\*7.1.5. In accordance with the Michigan State Construction Code Act, 1972 PA 230, as amended, MCL 125.1501 et seq., the State Department of Labor and Economic Growth, Construction Code Commission has adopted and filed with the Secretary of State the following Construction Code Reference Standards: (a) Michigan Building Code; (b) Michigan Plumbing Code; (c) National Electric Code; (d) Michigan Mechanical Code; (e) State Elevator Code; (f) State Boiler Code; and (g) State Barrier Free Design Rules.

**7.2 Sales and Use Tax and Other Similar Taxes:**

7.2.1. The **Contractor** shall be responsible for and pay all Michigan sales and use taxes and any other similar taxes covering the Work that are currently imposed by legislative enactment and as administered by the Michigan Department of Treasury, Revenue Division. The **Owner** shall make a corresponding adjustment in Contract Price for any increase or decrease in sales, use and other similar taxes (excluding payroll taxes) covering the Work that are enacted after the date of Bid opening.

**7.3 Safety and Protection:**

7.3.1. The **Contractor** shall comply with and shall require all Subcontractors and Suppliers to comply with, all Laws governing the safety and protection of persons or property, including, but not limited to the Michigan Occupational Safety and Health Act (1974 PA 154, as amended, MCL 408.1001 et seq.) and all rules promulgated under the Act. The **Contractor** shall be responsible for all fines and penalties imposed for any related violation(s) of federal and State health and safety requirements. The **Contractor's** safety representative at the site shall be the superintendent required by the provisions of paragraph 4.2.2, unless otherwise designated in writing by the **Contractor**.

7.3.2. The **Contractor** shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs. The **Contractor** shall take all necessary precautions for the safety of, and shall erect and maintain all necessary safeguards and provide the necessary protection to prevent damage, injury or loss to: (a) all employees on the Work and other persons who may be affected by the Work, (b) all the Work and materials and equipment to be incorporated into the Work, whether stored on or off the site, and (c) other property at or adjacent to the site, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and Underground Utilities not designated for removal, relocation or replacement. In the event of severe weather, the **Contractor** shall immediately inspect the Work and the site and take all reasonably necessary actions and precautions to protect the Work and ensure that public access and safety are maintained.

7.3.2.1. All damage, injury or loss to the Work, materials and equipment and such other property caused, directly or indirectly, in whole or in part, by the **Contractor** shall be remedied by the **Contractor**, except to the extent due to fault of the Drawings or Specifications or to act or omission of the **Owner** or **Professional**, and not due to, directly or indirectly, in whole or in part, to the fault or negligence of the **Contractor** or any Subcontractor or Supplier.

7.3.2.2. The **Contractor** shall notify owners of adjacent property and Underground Utilities when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

7.3.2.3. Except as the division of responsibilities for safety may be otherwise delineated in writing between the **Owner** and **Contractor** in a Substantial Completion certificate, the **Contractor** duties and responsibilities for safety and protection shall continue until such time as the **Professional** is satisfied that the Work, or Work inspected, is completed and ready for final payment.

7.3.3. Use of Explosives – The **Contractor** shall comply with all federal, state, and local Laws governing the use of explosives, obtain and pay for any required permits before their use and furnish a copy of the permits to the **Professional** before using explosives.

The **Contractor** shall, under the supervision of competent and suitably trained and qualified personnel, exercise the utmost care not to endanger life or damage property in the transportation, storage, handling, use and disposal of explosives, and in the use of Means and Methods. The **Contractor** shall be responsible for all injury, damage and adverse impacts outside the permit area resulting from the use of explosives (including an appropriate portion of the Delay and costs resulting from such injury, damage, and impacts).

#### 7.4 Bonds and Insurance – General Requirements:

7.4.1. Both the Section 00610 Performance Bond and Section 00620 Payment Bond shall remain in full force and effect from the date of Contract Award until final completion of the Work or the end of the Correction Period, whichever comes later. The **Contractor** shall furnish any other bonds (e.g., manufacturer performance Bond or maintenance Bond) required by Section 00800 Supplementary Conditions or the technical Specifications.

7.4.2. The **Contractor** shall purchase and maintain insurance providing the coverages and limits designated in this Article. Insurance shall be provided by insurers authorized to do business as insurer in the State, as evidenced by a Certificate of Authority issued by the Department of Consumer and Industry Services – Insurance Bureau. Also, and unless otherwise authorized in writing by the **Owner**, insurers shall have an "A-" A.M. Best Company Rating and a Class VII or better financial size category as shown in the most current A.M. Best Company ratings. The **Contractor** shall not start to perform and furnish the Work, or continue with any part of the Work, unless the **Contractor** has in full force and effect all the required insurance.

7.4.3. Insurance policies shall contain a provision or endorsement stating that coverage will not be canceled or materially changed, or renewal refused unless at least thirty (30) Calendar Days prior written notice has been personally delivered or sent by registered mailed to the **Owner** and **Contractor**. Any coverage nearing expiration during the period in which it is to remain in full force and effect shall be renewed before its expiration, and an acceptable certificate of insurance shall be filed with the **Owner** at least thirty (30) Calendar Days before it expires.

7.4.4. If any of the **Contractor's** sureties or insurers is declared bankrupt or placed into receivership, ceases to meet the requirements of the Contract Documents or its authority to do business in the State is revoked or expires, the **Contractor** shall immediately substitute other Bonds/sureties or insurers/policies, which shall meet the requirements of the Contract Documents.

#### 7.5 The Contractor's Liability Insurance:

7.5.1. The **Contractor** shall maintain Workers' Compensation and Employer's Liability, Commercial General Liability, Commercial Automobile Liability, Excess Liability, and such other insurance as may be designated in Section 00800 Supplementary Conditions or as is appropriate for the Work. The **Contractor's** liability insurance shall provide protection from claims which may arise out of or result from the **Contractor's** performance and furnishing of the Work and the **Contractor's** other obligations under the Contract Documents, whether performed or furnished by the **Contractor**, any Subcontractor, any Supplier, or anyone for whose acts any of them may be liable.

7.5.2. Liability Insurance shall be endorsed to list as additional insureds the **State of Michigan** (Owner), its departments, divisions,

agencies, offices, commissions, officers, employees and agents, the **Owner's** consultants, and agents, the **Professional**, and the **Professional's** consultants and agents, including their respective subsidiaries and affiliates and their respective directors, officers, shareholders, agents, or employees. The **Contractor** shall use the current Insurance Services Office (ISO) Form CG 20 09 for general liability insurance or equivalent, ISO Form CA 20 01 for automobile liability insurance or equivalent, and manuscript form for excess liability insurance. The insurance afforded to the additional insureds shall be primary, and neither the coverages nor limits under the **Contractor's** policies shall be reduced or prorated by the existence of any other insurance applicable to any loss that the additional insureds may have sustained. Workers' Compensation, Employer's Liability Insurance and all other liability insurance policies shall be endorsed to include a waiver of rights to recover from the **Owner**, **Professional** and the other additional insureds.

7.5.3. The **Contractor's** liability insurance shall remain in effect through the Correction Period and through any special correction periods that are implemented pursuant to the requirements of paragraph 9.5.3. Liability insurance issued on a claims-made basis and completed operations insurance shall be maintained for two (2) years after final payment, and evidence of coverage shall be furnished to the **Owner** yearly.

7.5.4. For any employee, resident of and hired in Michigan, the **Contractor** shall have insurance for benefits payable under Michigan's Workers' Compensation Law. For any other employee protected by Worker's Compensation Laws of any other state, the **Contractor** shall have insurance or participate in a mandatory state fund, where applicable, to cover the benefits payable to any such employee.

7.5.5. Commercial General Liability Insurance shall be equivalent to that provided by the current edition of standard ISO Form CG 00 01, and shall include contractual liability and underground, explosion and collapse hazard exposure operations and pile driving operations (if risk is present).

7.5.6. Commercial Automobile Liability Insurance coverage shall be equivalent to that provided by the current edition of the ISO Form CA 00 01 and include Michigan statutory requirements.

7.5.7. Excess Liability Insurance shall provide the following protections: employer's liability, general liability, and automobile liability. Excess Liability Insurance shall be at least as broad as the underlying policies of liability insurance.

7.5.8. Coverage Limits - Workers' Compensation and Employer's Liability Insurance shall conform to statutory limits under Michigan Law. Commercial General Liability limits shall be \$2,000,000.00 each occurrence, \$2,000,000.00 general aggregate, \$2,000,000.00 products and completed operations aggregate, and \$2,000,000.00 personal and advertising injury. Commercial Automobile Liability limits shall be \$2,000,000.00 combined single limit. Excess Liability limits shall be \$2,000,000.00 each occurrence and aggregate, if the Contract Price is less than \$10,000,000.00, and \$5,000,000.00 each occurrence and aggregate, otherwise. Deductible amounts shall not exceed \$25,000.00.

7.5.9. The **Contractor** shall promptly notify the **Owner** in writing of (a) any reduction in coverage limits over \$100,000.00 resulting from Work under the Contract Documents or otherwise, and (b) any claim notice involving the Work. Notification of a claim shall provide full details and an estimate of the amount of loss or



liability. If it turns out that the aggregate limits have been impaired to the extent that they are no longer adequate for the Work, the **Contractor** shall promptly reinstate the coverage limits and submit to the **Owner** certificates of insurance confirming that coverage has been reinstated to the specified limits.

7.5.10. These requirements shall not be construed to limit the liability of the **Contractor** or its insurers. The **Owner** does not represent that the specified coverages or limits of insurance are sufficient to protect the **Contractor's** interests or liabilities.

#### 7.6 Pollution Liability Insurance

(...\*\*\* Professional to include Pollution Liability Insurance if needed \*\*\*...)

7.6.1. Pollution Liability Insurance in the amounts of not less than \$2,000,000 per occurrence is required. **7.7 Property Insurance (Builders Risk Insurance)**

\*7.7.1. The **Contractor** shall purchase and maintain property insurance for one hundred percent (100%) of the actual cash replacement value of the insurable Work while in the course of construction, including foundations, additions, attachments, and all fixtures, machinery and equipment belonging to and constituting a permanent part of the building structure. The property insurance also shall cover temporary structures, materials and supplies of all kinds, to be used in completing the Work, only while on the building site premises or within five hundred (500) feet of the site. The property insurance shall insure the interests of the **Owner**, **Contractor** and all Subcontractors and Suppliers at any tier as their interests may appear. The property insurance shall insure against "all risk" of physical loss or damage to the extent usually provided in policy forms of insurers authorized to transact this insurance in Michigan. Any deductible shall be both the option and responsibility of the **Contractor**.

\*7.7.2. A certificate or other proof of coverage shall be provided prior to final contract execution or issuance of a purchase order by the State. A copy of the master insurance policy will be made available to the **Owner** upon request.

7.7.3. The **Contractor** and **Owner** will cooperate in determining the actual cash replacement value of any insured loss. Any deductible amount shall be assumed or shared by the **Contractor** and Subcontractors, at any tier, in accordance with any agreement the parties in interest may reach.

7.7.4. The **Owner** may purchase and maintain for its benefit boiler and machinery insurance for boiler and machinery required to be registered and inspected by Law.

#### 7.8 Waiver of Rights:

7.8.1. To the extent any losses and damages caused by any of the perils covered by property insurance covering the Work (whether under paragraph 7.7 or otherwise) are covered and payments are made, the **Owner** and **Contractor** waive all rights against each other for any such losses and damages and also waive all such rights against the **Professional** and all other Persons named as insureds or additional insureds in such policies. Each Sub agreement shall contain similar waiver provisions by the Subcontractor or Supplier in favor of the **Owner**, **Professional**, and all other Persons named as insureds or additional insureds. None of these waivers shall extend to the rights that any of the insureds

may have to the proceeds of insurance held by the **Owner** as trustee or otherwise payable under a policy so issued.

7.8.2. The **Owner** and **Contractor** intend that the required policies of property insurance shall protect all the parties insured and provide primary coverage for all losses and damages caused by the perils covered. Accordingly, all such policies shall be endorsed to provide that in the event of payment of any loss or damage the insurer will have no rights of subrogation or other recovery against any of the parties named as insureds or additional insureds, and if the insurers require separate waiver forms to be signed by the **Professional** or the **Owner's** and **Professional's** consultants, the **Owner** will obtain such waiver forms, and if required of any Subcontractor or Supplier, the **Contractor** will obtain such waiver forms as well.

#### 7.9 Receipt and Application of Proceeds:

7.9.1. Any insured loss under the policies of property insurance will be adjusted with the **Owner** and will be made payable to the **Owner** as trustee for the insureds, as their interests may appear, subject to the conditions of paragraph 7.9.2. The **Owner** shall deposit, in a separate account, and shall distribute monies received based on any agreement the parties in interest may reach. If no other distribution agreement is reached, the damaged Work shall be replaced or repaired, the monies received shall be used for that purpose and the Work Involved and resulting costs shall be covered by Change Order.

7.9.2. The **Owner**, as trustee, shall have power to adjust and settle any loss with the insurers unless a party in interest objects in writing within fifteen (15) Calendar Days after the occurrence of loss to the **Owner's** exercise of this power. If an objection is made, the **Owner** as trustee shall settle with the insurers pursuant to any agreement the parties in interest may reach.

#### \*7.10 Unfair Labor Practice:

\*7.10.1. The **Owner**, pursuant to 1980 PA 278, as amended by MCL 423.321(b), may void and rescind the Contract if, at any time, the **Contractor** or any Subcontractor or Supplier appears on the register maintained by the Michigan Department of Consumer and Industry Services of employers who have been found in contempt of court by a Federal Court of Appeals on not less than three occasions involving different violations during the preceding seven (7) years for failure to correct unfair labor practices as prohibited by Section 8 of Chapter 372 of the National Labor Relations Act, 29 U.S.C. 158.

#### \*7.11 Michigan Right-To-Know Law:

\*7.11.1. The **Contractor** shall comply with Section 14a-14n of the Michigan Occupational Safety and Health Act (MIOSHA), 1974 PA 154, as amended, MCL 408.1014a – MCL 408.1014n, commonly referred to as the "Michigan Right-to-Know Law" and the rules promulgated under the Act. The Act places certain requirements on employers to develop a communication program designed to safeguard the handling of hazardous chemicals through labeling of chemical containers and development and availability of Safety Data Sheets (SDS), and to provide training for employees who work with these chemicals and develop a written hazard communications program.

\*7.11.2. Provisions of the Michigan Right-to-Know Law may be found in those sections of the Michigan Occupational Safety and

Health Act (MIOSHA), which contain Right-to-Know provisions, and the Federal Hazard Community Standard, which is part of the MIOSHA Right-to-Know Law through adoption. The Act, rules and standards should be reviewed for additional requirements.

\*7.11.3. The Michigan Right-to-Know Law also provides for specific employee rights, including the right to be notified of the location of SDS and to be notified at the site of new or revised SDS within five (5) Business Days after receipt and to request SDS copies from their employers. The **Contractor**, employer or Subcontractor shall post and update these notices at the site.

#### \*7.12 Nondiscrimination:

\*7.12.1. The **Contractor** and each Subcontractor and Supplier covenants to comply with the following requirements:

\*7.12.1.1. Not to discriminate against any employee or employment applicant because of race, religion, color, national origin, age, sex (as defined in *Executive Directive 2019-09*), height, weight, marital status, or a physical or mental disability that is unrelated to the individual's ability to perform the duties of the particular job or position.

\*7.12.1.2. To take action to ensure that applicants are employed and that employees are treated during employment without regard to their race, religion, color, national origin, age, sex, height, weight, marital status, or a physical or mental disability that is unrelated to the individual's ability to perform the duties of the particular job or position. Such action shall include, but is not limited to employment upgrading, demotion or transfer; recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

\*7.12.1.3. To state, in all solicitations or advertisements for employees, that all qualified applicants will receive consideration for employment without regard to race, religion, color, national origin, age, sex, height, weight, marital status, or a physical or mental disability that is unrelated to the individual's ability to perform the duties of the particular job or position.

\*7.12.1.4. To send, or have its collective bargaining representative send, each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice advising that labor union or worker's representative of commitments under this provision.

\*7.12.1.5. To comply with the Elliot-Larsen Civil Rights Act, 1976 PA 453, as amended, MCL 37.2201 et seq.; the Michigan Persons With Disabilities Civil Rights Act, 1976 PA 220, as amended, MCL 37.1101 et seq.; *Executive Directive 2019-09*; and all published rules, regulations, directives, and orders of the Michigan Civil Rights Commission which may be in effect on or before the date of Bid opening.

\*7.12.1.6. A breach of the covenants set forth in paragraphs 7.12.1.1 through 7.12.1.5 shall be regarded as a material breach of the Contract.

\*7.12.2. The **Contractor** shall furnish and file compliance reports within the times, and using the forms, prescribed by the Michigan Civil Rights Commission. Compliance report forms may also elicit information as to the practices, policies, programs, and employment statistics of the **Contractor** and Subcontractors. The **Contractor** shall permit access to Records by the Michigan Civil

Rights Commission and its agent for the purposes of ascertaining compliance with the Contract Documents and with rules, regulations, and orders of the Michigan Civil Rights Commission.

\*7.12.3. If, after a hearing held pursuant to its rules, the Michigan Civil Rights Commission finds that the **Contractor** has not complied with the nondiscrimination requirements of the Contract Documents, the Michigan Civil Rights Commission may, as part of its order, certify said findings to the **Board**. Upon receipt of certification, the **Board** may order the cancellation of the Contract and/or declare the **Contractor** ineligible for future contracts with the State, until the **Contractor** complies with said order of the Michigan Civil Rights Commission.

#### \*7.13 Michigan Residency for Employees:

\*7.13.1. Fifty percent (50%) of the persons employed on the Work by the **Contractor** shall have been residents of the State of Michigan for not less than one year before beginning employment on the Work. This residency requirement may be reduced or omitted in writing, at the sole discretion of the **Owner**, to the extent that Michigan residents are not available or to the extent necessary to comply with federal Law concerning federal funds used for the Project. A breach of this requirement shall be considered a material breach of the Contract.

\*7.13.2. This residency requirement shall not apply to the **Contractor** or to any Subcontractor if the **Contractor** or any such Subcontractor is signatory to collective bargaining agreements which allow for the portability of employees on an interstate basis (The Management and Budget Act, 1984 PA 431, as amended, MCL 18.1241a).

#### \*7.14 Prevailing Wages:

\*7.14.1. The term "the **Contractor**", as used in this paragraph, shall include the **Contractor** and all the **Contractor's** Subcontractors and their respective lower tier Subcontractors and all construction persons (whether general contractors, prime contractors, project managers or trade contractors) in privity of contract with any of them.

\*7.14.2. To the extent applicable, Contractor will comply with federal, state, and local prevailing wage requirements.

### ARTICLE 8 PROSECUTION; SUBSTANTIAL COMPLETION

#### 8.1 Starting the Work:

8.1.1. Within fifteen (15) Calendar Days after the **Owner** executes the Section 00500 Agreement, a pre-construction conference will be held. The conference will be intended, without limitation, to (a) review the **Contractor's** Schedule of Shop Drawing submissions; (b) review the qualifications of key **Contractor** personnel; (c) review the **Contractor's** proposed normal working hours and plans for laydown, staging, construction traffic, access to the site, parking and other similar matters; (d) review procedures for Submittals, clarifications and interpretations (including reasonable times for response turnaround), Change Orders, Change Authorizations and Record Documents; and (e) exchange twenty-four (24) hour emergency telephone numbers for key personnel.

8.1.2. The **Contractor** shall start the Work on the Date of Commencement of the Contract Time. No Work shall be started at the site before such is allowed by the Contract Documents.

**8.2 Revision 0 (Rev. 0) Schedule and Cost Submittals:**

8.2.1. The **Contractor** shall deliver the interim Rev. 0 Progress Schedule, Schedule of Shop Drawing submissions and Rev. 0 Progress Schedule as required in the Contract Documents. The **Contractor** shall correct and adjust any Rev. 0 Submittal returned for revision. The finalized Revision 0 *As-Planned* Schedule shall be the Progress Schedule from which Revision Schedules shall be developed and used by the **Contractor** when making proposals or claims for adjustments in Contract Time and/or Contract Price.

**8.3 Compliance with Contract Time Requirements:**

8.3.1. The **Contractor** shall prosecute the Work with the diligence necessary to ensure its completion within the Contract Times. The **Contractor** shall provide sufficient management, supervision, labor, materials and equipment, and the **Contractor** shall undertake appropriate action promptly to recover schedule when necessary to comply with the Contract Times.

8.3.2. Unless disallowed by any Law or modified in another Section of the Specifications, a daily schedule from 06:00 AM to 06:00 PM, during Business Days, shall be normal working hours. Except in an Emergency, or as may be required by the **Contractor's** safety and protection obligations, or as the **Owner** and **Contractor** may otherwise agree, all Work at the site shall take place during normal working hours. The **Contractor** shall provide written notice to the **Owner** at least twenty-four (24) hours and up to seventy-two (72) hours if so, noted for projects specific requirements such as Correctional Facilities, before performing Work outside of normal working hours.

8.3.3. Unless otherwise agreed in writing by the **Owner**, for any Work actually performed outside of normal working hours, the **Contractor** shall reimburse the **Owner** any related increases in costs the **Owner** incurs, provided those costs are costs which the **Contractor** could reasonably have foreseen, and which are not offset through the earlier completion of the Work resulting from working outside of normal working hours. Examples of **Owner** costs include, but are not limited to, overtime charges of the **Professional** and payments for custodial and security personnel.

8.3.4. Early Dates in the Progress Schedule shall be based on proceeding with all or part of the Work exactly on the date when the corresponding Contract Time commences to run. Late Dates shall be based on completing all or part of the Work exactly on the corresponding Contract Time, regardless of whether the **Contractor** anticipates early completion or not. If sequences of Work are indicated in or required by the Contract Documents, the Progress Schedule shall show in sufficient detail the **Contractor's** approach to conforming with those sequences.

8.3.5. The Progress Schedule shall reflect the **Contractor's** approach to Work remaining, be employed when reporting on progress or schedule recovery and facilitate the evaluation of Requests for Payment, as provided in the Contract Documents.

8.3.6. The **Contractor** shall carry on the Work with due diligence during all disputes or disagreements with the **Owner**. No Work shall be delayed or postponed pending resolution of any disputes or disagreements. The **Contractor** shall exercise reasonable precautions, efforts, and measures to avoid or mitigate situations that would cause Delays.

**8.4 Substantial Completion:**

8.4.1. The **Contractor** shall conduct inspections of the Work to verify the extent of completion. The **Contractor** shall provide to the **Owner** a list of items to be completed or corrected resulting from the inspections whenever the **Contractor**, upon completing all pre-requisite testing of the Work, considers that the Work, or any portion of the Work designated in the Contract Documents as having a separate, specified Substantial Completion, has progressed to the point that it is substantially complete.

8.4.2. Within a reasonable time after receiving the **Contractor's** list of items to be completed or corrected, the **Owner**, **Professional** and **Contractor** shall jointly conduct a Substantial Completion inspection. If, after consulting with the **Owner**, the **Professional** does not consider the Work, or portion of the Work inspected, substantially complete, the **Professional**, within twenty (20) Calendar Days after the inspection, will deliver to the **Owner** and **Contractor** a list of incomplete or Defective Work sufficient to demonstrate the basis for that determination.

8.4.3. If the **Professional** and **Owner** agree that the entire Work, or that the portion of the Work inspected, is substantially complete, the **Professional** will deliver to the **Owner** and **Contractor** a certificate of Substantial Completion with a Punch List.

The certificate shall (a) fix a reasonable date of Substantial Completion, (b) fix a date for completion of the Punch List to the satisfaction of the **Professional**, and (c) recommend the division of responsibilities between the **Owner** and **Contractor**. Neither the Work, nor any portion of the Work inspected, shall be substantially complete, unless the **Owner** can use the Work, or designated portion of the Work inspected, for the use intended.

8.4.4. Upon Substantial Completion of the Work, or designated part of the Work on which separate Substantial Completion and Contract Price are specified, payment may be made in full subject to (a) a withholding of two hundred percent (200%) of the value of any uncompleted Work, as determined by the **Professional**, and (b) any other deductions as the **Professional** may recommend or the **Owner** may withhold to cover Defective Work, liquidated damages and the fair value of any other items entitling the **Owner** to a withholding.

8.4.5. To the extent **Owner** training is required before Substantial Completion, the **Contractor** will provide the **Owner** copies of all related operating and maintenance (O&M) documentation before the start of training. Where **Owner** training for a portion of the Work is not required before Substantial Completion, the related O&M documentation will be provided no later than Substantial Completion. Final O&M documentation (with revisions made after Substantial Completion), will be furnished by the **Contractor** to the **Owner** before the request for final payment.

**8.5 Partial Use:**

8.5.1. Before Substantial Completion of the entire Work, the **Owner** may, at its sole option, use any portion of the Work for which a separate Substantial Completion has been specified in the Contract Documents. Before Substantial Completion of the entire Work, the **Owner** may, at its sole option, use any portion of the Work considered by the **Owner**, **Professional** and **Contractor** to be separately functioning Work that can be used without significant interference with the **Contractor's** completion of the balance of the

Work, even though a Substantial Completion for such Work is not specified in the Contract Documents.

8.5.2. If the **Owner** decides to use any portion of the Work, it shall inform the **Contractor** in writing. Unless such portion of the Work has undergone a Substantial Completion inspection under paragraph 8.4.2, within a reasonable time after receipt of the notice, the **Owner**, **Contractor** and **Professional** shall jointly make an inspection to determine the extent of completion. If the portion of the Work inspected is substantially complete, the provisions of paragraph 8.4.3 shall be followed by the **Owner**, **Professional** and **Contractor**. If the portion of the Work inspected is not substantially complete, the **Professional** will prepare a list of items remaining to be completed or corrected before that portion of the Work is considered substantially complete. Upon completing the list, the **Professional** will deliver the prepared list of items to the **Owner** and **Contractor**.

8.5.3. There shall be attached to the list a written recommendation about the division of responsibilities between the **Owner** and **Contractor** for those matters enumerated in paragraph 8.6.1 with respect to that portion of the Work, pending Substantial Completion of that portion of the Work and the entire Work. During Partial Use, and before Substantial Completion of the portion of the Work under Partial Use, the **Owner** shall allow the **Contractor** reasonable access to complete or correct listed items and to complete other Work. The **Owner** will not start any Partial Use unless the property insurer, by endorsement or like acceptable procedure, has acknowledged receipt of notice of and consent to Partial Use.

#### 8.6 Division of Responsibilities:

8.6.1. A certificate of Substantial Completion will include the **Professional's** recommendation about the division of responsibilities between the **Owner** and **Contractor** for utilities, security, safety, insurance, maintenance, etc. The **Owner** and **Contractor** will accept the division of responsibilities recommended by the **Professional** or shall negotiate a mutually agreeable split of responsibilities, which shall bind the **Owner** and **Contractor** when the **Owner** starts Partial Use.

#### 8.7 Suspension of Work:

8.7.1. Suspension of Work Order – The **Owner** may, at any time, order the **Contractor** in writing to defer, stop, slow down, suspend or interrupt all or any part of the Work for such period as the **Owner** may determine appropriate for its convenience. If any such written order Delays performance for an unreasonable period, the **Owner** will amend the Contract Documents to provide for a corresponding adjustment in Contract Time and/or Contract Price (excluding Fee under paragraph 11.11).

8.7.2. Constructive Suspension of Work – If performance of all or any part of the Work is, for an unreasonable period, deferred, stopped, slowed down, suspended or interrupted by any other act or failure to act of the **Owner** or **Professional**, or act or event attributable to the **Owner** under the Contract Documents, the **Owner** will negotiate with the **Contractor** or authorize an adjustment in Contract Time and/or Contract Price (excluding Fee under paragraph 11.11.1) for any increase in the time required to complete the Work and/or the **Contractor's** cost of performance.

8.7.3. Suspension of Work Limitation – No adjustment in Contract Price under paragraphs 8.7.1 or 8.7.2 shall be made to the

extent performance is delayed by any other cause, including any act or omission within the control of the **Contractor**. Further, no suspension of Work shall justify an increase in Contract Price or Contract Time unless the resulting Delay exceeds the time allowed in the Contract Documents for the act or failure to act.

8.7.4. If the **Contractor** believes a suspension of Work justifies an increase in Contract Price or Contract Time, the **Contractor** shall give prompt written notice to the **Owner** and submit a written proposal promptly after the extent of the Delay becomes known. However, no proposal or claim by the **Contractor** on account of a suspension of Work shall be allowed (a) for any Delay or costs incurred more than thirty (30) Calendar Days before the **Contractor** gives written notice (except for written orders under paragraph 8.7.1), or (b) if made after final payment.

#### 8.8 Sharing of Total Float On Non-Critical Paths:

8.8.1. The Progress Schedule shall be in the form of a Critical Path Schedule, Total Float on non-Critical Paths shall be available to the **Owner**, to the extent the **Owner's** use is reasonable given the Total Float remaining for the Work affected. If any such **Owner's** use of Total Float causes Delay which materially increases the **Contractor's** cost to complete the Work affected, and the **Contractor** notifies the **Owner** in writing and proceeds to support the assertion to the **Owner's** satisfaction, the **Owner** will correspondingly adjust Contract Price for any such material changes in the **Contractor's** cost to complete the Work.

8.8.2. The amount of Total Float available in the Progress Schedule shall not be artificially reduced by suppressing Total Float merely for the sake of voiding Total Float. Total Float hidden through the use of such techniques as preferential sequencing; slow or late starts of follow-on trades; restraining a Contract Time by Work actually required for a later Contract Time; the use of small crews, extended durations, imposed dates; and so forth, shall be Total Float otherwise available for sharing with the **Owner** under the provisions of paragraph 8.8.1.

### ARTICLE 9 WARRANTY; TESTS, INSPECTIONS AND APPROVALS; CORRECTION OF WORK

#### 9.1 Warranty:

9.1.1. The **Contractor** warrants to the **Owner** that all Work will conform to the Contract Documents and will not be Defective. Reasonably prompt notice of Defective Work of which the **Owner** or **Professional** has actual knowledge shall be given to the **Contractor**, but failure to do so will not void the **Contractor's** warranty unless actual prejudice results from such untimely notice. The **Contractor's** warranty excludes defect or damage caused by (a) abuse, modification by others, insufficient or improper operation or maintenance, or (b) normal wear and tear under normal usage.

9.1.2. Manufacturer warranties for materials and equipment received by the **Contractor** shall be assigned and promptly delivered to the **Owner**. Manufacturer warranties shall be in full force and effect for the entire duration of the Correction Period.

#### 9.2 Tests, Inspections and Approvals:

9.2.1. The **Owner**, **Professional**, their representatives and consultants, testing agencies and those State agencies and Political Subdivisions with jurisdiction shall be permitted access to the Work at reasonable times while the Work is in progress for On-Site

Inspection and/or inspection, testing or approval. The **Contractor** shall provide proper and safe conditions for such access. The **Contractor** shall give the **Professional** timely notice whenever any Work is ready for inspections, tests, or approvals, so that the **Professional** may observe such inspections, tests, or approvals. Tests, inspections, or approvals shall not in any way relieve the **Contractor** from the **Contractor's** obligations to perform the Work in accordance with the Contract Documents or warrant the Work as provided in the Contract Documents.

9.2.2. Unless otherwise provided in Section 00800 Supplementary Conditions, the **Owner** will retain a testing agency, directly or through the **Professional**, to perform inspections, tests or approvals required by the Contract Documents except for those inspections, tests or approvals specifically designated to the Contractor in the Contract Documents. The **Owner** will pay the charges of the testing agency, except if related to tests, inspections or approvals required by Law or otherwise charged to the **Contractor** under the provisions of paragraph 9.2.4 or 9.3.

9.2.3. The **Contractor** shall assume full responsibility for any testing, inspection, or approval (a) required by Law, (b) indicated in or required by the Contract Documents as designated to the Contractor, or (c) required for the **Professional's** acceptance of a Supplier, materials or equipment or mix designs submitted for prior approval by the **Contractor**. The **Contractor** shall (a) pay all related costs, except costs assumed by the **Owner** under paragraph 9.2.2, (b) schedule related activities, and (c) secure and furnish to the **Professional** the required certificates of inspection, testing or approval.

9.2.4. The **Contractor** shall be responsible for any testing, inspection or approval that reveals Defective Work, including an appropriate portion of the Delay and costs occasioned by such discovery of Defective Work. Examples of such costs assumed by the **Contractor** include, but are not limited to, charges of the **Professional** for repeated On-Site Inspections and, to the extent designated in the pertinent Specification, repeat testing, inspection, or approval charges by testing agencies.

### 9.3 Uncovering Work:

9.3.1. Any Work covered without the **Professional's** prior written concurrence shall, when requested by the **Professional**, be uncovered, exposed, or otherwise made available for On-Site Inspection, testing, inspection, or approval as the **Professional** may require, and replaced, if necessary. This requirement applies to Work, which requires On-Site Inspection by the **Professional**, based on the Contract Documents or on specific On-Site Inspection procedures of which the **Professional** notifies the **Contractor** in advance. This requirement also applies to Work, which is to be inspected, tested, or approved by others. The **Contractor** shall be responsible for any such uncovering, exposure, On-Site Inspection, testing, inspection, and satisfactory reconstruction, including an appropriate portion of the Delay and costs, unless the **Contractor** gave the **Professional** timely written notice of the **Contractor's** intentions to cover such Work and the **Professional** failed to act with reasonable promptness in response to such written notice.

9.3.2. The **Contractor**, at the **Professional's** request, shall uncover, expose, or otherwise make available for On-Site Inspection, testing, inspection, or approval any covered Work otherwise not required to be observed or inspected, tested, or approved before covering, if the **Professional** determines that such covered Work shall be on-site inspected by the **Professional** or inspected, tested, or approved by others. The **Contractor** shall be

responsible for any such uncovering, exposure, On-Site Inspection, inspection, testing and satisfactory reconstruction, including an appropriate portion of the Delay costs, whenever any such uncovered Work is found to be Defective. If, however, any such Work uncovered at the **Professional's** request is not found Defective, the **Owner** will amend the Contract Documents to provide for a corresponding adjustment in Contract Price and/or Contract Time.

### 9.4 Correction of Work:

9.4.1. Before the Correction Period – If required by the **Professional**, the **Contractor** shall correct all Defective Work, whether fabricated, installed or completed or not. If any Work is rejected by the **Professional** or if any testing, inspection, or approval reveals Defective Work, the **Contractor** shall promptly, as direct, remove the Defective Work from the site and replace it with non-Defective Work. The **Contractor** shall bear responsibility for its proportionate share of the Delay and costs resulting from the correction and/or the removal and replacement of Defective Work.

9.4.1.1. If the **Contractor**, within reasonable time after receipt of written notice, (a) fails to correct Defective Work or remove and replace rejected Work, or (b) fails to correct or complete items on any Punch List, or (c) fails to perform Work in accordance with the Contract Documents, or (d) fails to comply with any other provision of the Contract Documents, the **Owner**, after seven (7) Calendar Days' written notice to the **Contractor**, may correct and remedy the deficiency. To the extent necessary to correct and remedy such deficiency, the **Owner** shall be allowed to exclude the **Contractor** from all or part of the site; take possession of all or part of the Work and stop related operations of the **Contractor**; take possession of the **Contractor's** tools, plant and office and construction equipment at the site; and incorporate into the Work materials and equipment for which the **Owner** has paid the **Contractor**. The **Contractor** shall allow the **Owner** and **Professional** access to the site as the **Owner** may require completing corrective and remedial action. The **Owner** shall be entitled to an appropriate decrease in Contract Price for all claims, costs, losses, damages, and Delay incurred or sustained by the **Owner** which are attributable to the **Contractor**. Costs assumed by the **Contractor** under this provision include, without limitation, costs of correction or removal and replacement of Defective Work, costs of repair and replacement of other work destroyed or damaged by the action and related charges of the **Professional**.

9.4.1.2. Instead of requiring correction or removal and replacement of any Defective Work, the **Owner**, with the advice of the **Professional**, may prefer to accept any Defective Work. In any such case, the **Contractor** shall bear its proportionate share of the Delay and costs associated with the **Owner's** determination to accept the Defective Work. If the **Owner's** acceptance of the Defective Work takes place before the **Professional's** recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents, and the Contract Price shall be adjusted accordingly.

9.4.2. Correction Period – The Contract Documents provide for one Correction Period for the entire Work, whether Partial Use of any portion of the Work is designated as eligible by the Contract Documents or not. The Correction Period shall start on the date of Substantial Completion of the Work, or on a later date, if so, provided in the Contract Documents. The Correction Period shall last one year, or longer, if so, specified in the Contract Documents.

9.4.3. Correction of Work During the Correction Period – The **Contractor** shall correct Defective Work or, if rejected by the **Owner**, remove from the site, and replace any Defective Work with non-Defective Work. The **Contractor's** corrective action shall be in accordance with the **Owner's** written instructions and shall be accomplished at the **Contractor's** sole expense. If the Defective Work causes an Emergency or unacceptable risk of loss or damage, the **Contractor** shall take immediate action to correct or remove and replace the Defective Work.

9.4.3.1. If the **Contractor** fails to take corrective action in accordance with the terms of any such **Owner** written instruction, the **Owner**, directly or through others under contract with the **Owner**, may correct or remove and replace the Defective Work. In any such case, the **Contractor** shall bear its proportionate share of all resulting claims, costs, losses, and damages. If the **Owner** and the **Contractor** are unable to agree as to the amounts due by the **Contractor** to the **Owner** under the provisions of this paragraph, the **Owner** may deliver a claim, in accordance with the procedures and within the deadlines set forth in Article 15. If the discovery of the Defective Work takes place after final payment and the **Contractor** fails to pay the **Owner** any of the amounts due under the provisions of this paragraph, the **Owner** shall demand due performance under Section 00610 Performance Bond and Article 14 or deliver a claim, in accordance with the procedures and within the deadlines set forth in Article 15, or both.

9.4.4 After the Correction Period – Until the period of limitation provided by Michigan Law, the **Contractor** shall promptly correct Defective Work upon receipt of written notice from the **Owner**. If appropriate under the circumstances or, in the event of an Emergency or unacceptable risk of loss or damage, the **Owner**, directly or through others under contract with the **Owner**, may correct or remove and replace the Defective Work.

9.4.5. It is not the intent of paragraph 9.4 or paragraph 9.5 to establish a period of limitations for the **Contractor's** warranty or to limit the obligations of the **Contractor** to warrant that the Work will not be Defective. The specified correction of Work requirements relates only to the specific obligation of the **Contractor** to correct or remove and replace Defective Work. The specified correction of Work requirements has no limitation on the rights of the **Owner** to have Defective Work corrected or removed and replaced, if rejected, except as otherwise provided by Michigan Law.

## 9.5 Special Correction Period Requirements:

9.5.1. Whenever the **Owner** undertakes Partial Use of any portion of the Work specifically designated as eligible for Partial Use in the Contract Documents, the warranties for all materials and equipment incorporated into that portion of the Work shall remain in full force and effect between the start of such Partial Use and the date when the Correction Period starts. If no separate price for such special correction period was requested in Section 00300 Bid Form and made part of the Contract Documents, the **Owner** will appropriately adjust the Contract Price.

9.5.2. Whenever the **Owner** undertakes Partial Use of any portion of the Work because any act or omission within the control of the **Contractor** Delays completion of the Work, or any portion of the Work, within a designated Contract Time, the warranties for all materials and equipment incorporated into that portion of the Work shall, at no adjustment in Contract Price, be maintained in full force and effect between the beginning date of such Partial Use and the date when the Correction Period starts.

9.5.3. The correction period for any Defective Work that is corrected or rejected and replaced within the last three (3) months of the Correction Period shall be extended by an additional six (6) months, starting on the date such Work was made non-Defective.

9.5.4. The Contract Documents may require the Correction Period to start on a date later than the date of Substantial Completion of the entire Work. If such is the case, and the **Owner** advances or defers the start of the Correction Period, the **Contractor** shall maintain the warranties for materials and equipment until the revised starting date of the Correction Period. If no separate price for such advance or deferment was requested in Section 00300 Bid Form and made part of the Contract Documents, the **Owner** will amend the Contract Documents to appropriately adjust the Contract Price.

## 9.6 Special Maintenance Requirements:

9.6.1. If the Contract Documents specify that the entire Work, or a portion of the Work, upon reaching Substantial Completion, shall not be placed in use by the **Owner**, the **Contractor** shall maintain the Work, or specified part of the Work, in good order and proper working condition and shall take all other actions necessary for its protection between the certified date of Substantial Completion and the date when the Work, or designated part of the Work, is placed in use.

9.6.2. If no separate price for such special maintenance period was requested in Section 00300 Bid Form and made part of the Contract Documents, the **Owner** will amend the Contract Documents to appropriately increase the Contract Price.

## ARTICLE 10 CHANGES

### 10.1 Changes in the Work:

10.1.1. Changes in the Work – The **Owner** is entitled to make changes within the general scope of the Work consisting of (a) additions, deletions or other revisions in the Specifications and Drawings, any Means and Methods or the **Owner**-furnished lands, equipment, materials, or services, or (b) directing acceleration of the Work. Changes in the Work may be accomplished through negotiated, *bilateral* Change Orders or *unilateral* Change Orders or result from any other properly authorized written order from the **Owner** or **Professional** which represents a constructive change.

10.1.2. Negotiated Changes – The **Owner** may negotiate changes in the Work by directing the **Professional** to prepare a Bulletin in numerical sequence describing the change being considered. Upon receiving a Bulletin, the **Contractor** (with the appropriate Subcontractors) shall evaluate the described change and quote the Bulletin. In estimating adjustments in Contract Price and/or Contract Time, the **Contractor** shall follow the provisions, including the breakdown requirements, specified in Article 11.

10.1.3. Constructive Changes – Any written order (including instruction, interpretation, determination, authorization, or approval) from the **Owner** or **Professional** that causes a change in the Contract Documents shall constitute a change in the Work, provided the **Contractor** or the **Owner** gives prompt, written notice of a change to the other (with copy to the **Professional**) stating the date, circumstances, and source of the change.

10.1.3.1. Upon receipt and evaluation of the written notice, if the **Owner** agrees, with the **Professional's** advice, that a change within the general scope of the Work has been ordered, the **Owner**

shall, by Change Order or Change Authorization, correspondingly amend the Contract Documents. If the **Owner** finds that a change within the general scope of the Work has not been ordered, and the **Contractor** disagrees, the **Contractor** may deliver notice of a claim and a claim Submittal in accordance with the procedures and within the deadlines set forth in Article 15.

10.1.3.2. **No proposal or claim** by the **Contractor** on account of changes under paragraphs 3.2.1, 10.1.3 or any other matter for which Contractor asserts added cost or time **shall be allowed unless initiated by written notice** of such proposal or claim to the Professional and Owner **within 21 days after the occurrence of the event giving rise to such proposal or claim or within 21 days after the contractor first recognizes the condition giving rise to the proposal or claim.** A full and detailed breakdown of cost and time requested, with supporting documentation, if not provided with initial notice shall be delivered to Professional and Owner within 15 days of the notice, as noted in article 11.1.2, unless otherwise agreed in writing, by the Owner prior to expiration of such time.

10.1.4. Unilateral Changes – If, in negotiations, the **Owner** and **Contractor** are unable to agree on the adjustment in Contract Price or Contract Time corresponding to any change in the Work, the **Owner** may issue a *unilateral* Change Order. Upon receiving any such Change Order, the **Contractor** shall promptly proceed or continue with the Work Involved as required by the Change Order.

10.1.4.1. *Unilateral* Change Orders may adjust Contract Price and/or Contract Time, as the **Owner**, with the advice of the **Professional**, may determine appropriate. Contract Price may be adjusted on a *lump sum* basis or an *actual cost, not to exceed* basis. If the **Contractor** disagrees with the extent of the adjustments in Contract Price and/or Contract Time made by any such *unilateral* Change Order, the **Contractor** may deliver notice of a claim and a claim Submittal in accordance with the procedures and within the deadlines set forth in Article 15.

## 10.2 Differing Subsurface or Physical Site Conditions:

10.2.1. The Contract Documents make available Authorized Technical Data concerning subsurface site conditions and physical conditions of existing surface and subsurface facilities at the site. Consistent with Section 00100 Instructions to Bidders, except for reasonable reliance on the accuracy of Authorized Technical Data, the **Owner** does not warrant that Authorized Technical Data is necessarily sufficient and complete for the purposes of selecting Means and Methods, initiating, maintaining, and supervising safety precautions and programs or discharging any other obligation assumed by the **Contractor** under the Contract Documents.

10.2.2. The **Contractor** or **Owner** shall notify the other in writing if the **Contractor** or **Owner**, respectively, discovers that (I) actual subsurface conditions or latent physical conditions of existing surface and subsurface facilities encountered at the site differ materially from those shown or indicated in the Contract Documents, or (II) unknown subsurface conditions or unknown physical conditions of existing surface and subsurface facilities encountered at the site, of an unusual nature, differ materially from those ordinarily encountered and recognized as inherent in work similar in character to the Work. A written notice from the **Contractor** shall be delivered promptly before the conditions are disturbed and before proceeding with the affected Work. A written notice from the **Owner** shall be delivered promptly after the **Owner** has knowledge of the differing subsurface or physical conditions.

10.2.2.1. Upon receipt or delivery of any such notice, the **Owner** shall investigate the differing conditions asserted. If, with the **Professional's** advice, the **Owner** determines that conditions on which the **Contractor** is entitled to rely do differ materially, the **Owner** will amend the Contract Documents to provide for any changes in the Work and adjustments in Contract Price and Contract Time made necessary by the differing conditions and any resulting Delay which is not reasonably anticipatable under the circumstances and which is attributable to the **Owner** and/or **Professional**. Unless the **Owner** and **Contractor** otherwise agree, no increase in Contract Time shall be made for any suspension of Work made necessary by any differing subsurface conditions, if the suspension of Work lasts less than ten (10) Calendar Days.

10.2.2.2. If the **Owner** determines that the actual conditions encountered and those conditions on which the **Contractor** is entitled to rely do not differ materially, and the **Contractor** disagrees with the **Owner's** determination, the **Contractor** may deliver notice of a claim and a claim Submittal in accordance with the procedures and within the deadlines set forth in Article 15.

10.2.2.3. No proposal or claim by the **Contractor** due to differing site conditions shall be allowed (a) if the **Contractor** knew of their existence before submitting its Bid or if those conditions could have been discovered by any reasonable examinations for which the **Contractor**, as Bidder, was made responsible under the Bidding Requirements, and/or (b) unless the **Contractor's written notice** is provided **within not more than 21 days after the contractor first recognizes the condition giving rise to the proposal or claim and gives the Owner adequate opportunity to investigate the asserted differing site conditions.** A full and detailed breakdown of cost and time requested, with supporting documentation, if not provided with initial notice shall be delivered to Professional and Owner within 15 days of the notice, as noted in article 11.1.2, unless otherwise agreed in writing, by the Owner prior to expiration of such time.

10.2.3. The provisions of paragraph 10.2.2 through 10.2.2.3 also shall apply to situations where the **Contractor** or **Owner** discovers that any reference points provided by the **Owner** need correction to enable the **Contractor** to proceed with the Work.

## 10.3 Responsibilities for Underground Utilities:

10.3.1. The **Contractor** shall comply with 1974 PA 53, as amended, MCL 460.701 *et seq.*, and all other Laws concerning Underground Utilities. In addition, the **Contractor** shall be responsible for immediately notifying the **Owner** of any contact with or damage to Underground Utilities, and for the safety, protection of and repairing of any damage done to any Work and any surface and subsurface facilities. Except as provided under 1974 PA 53, as amended, MCL 460.701 *et seq.*, paragraph 10.3.2 or by any Allowance specific to Underground Utilities, the **Contractor** shall bear an appropriate portion of the Delay and costs relating to the obligations set forth in this paragraph.

10.3.2. Shown or Indicated – If the **Contractor** encounters Underground Utilities shown or indicated (whether in the Contract Documents or those documents itemized in Section 00210 Information for Bidders) that are inaccurately shown or are inaccurately located, responsibility for any damage shall be as provided in MCL 460.701 *et seq.* To the extent the Drawings and/or Specifications inaccurately show or locate, through error or omission, the actual physical conditions and/or location of existing Underground Utilities (when compared with the information and data provided by the owners of such Underground Utilities), the **Owner**



will amend the Contract Documents to provide for a corresponding adjustment in Contract Price and/or Contract Time.

10.3.3. Not Previously Located – If the **Contractor** encounters not previously located Underground Utilities, which could not reasonably have been foreseen, the **Owner** will amend the Contract Documents to provide for any changes in the Work and corresponding adjustments in Contract Price and/or Contract Time made necessary by such changes in the Work and by any resulting Delay which is not reasonably anticipatable under the circumstances and which is attributable to the **Owner** and/or **Professional**.

#### 10.4 Hazardous Material Conditions:

10.4.1. The **Contractor** shall use, handle, store, dispose of, process, transport and transfer any material considered a Hazardous Material in accordance with all federal, state, and local Laws. If the **Contractor** encounters material reasonably believed to be a Hazardous Material and which may present a substantial danger, the **Contractor** shall immediately stop all affected Work, give written notice to the **Owner** of the conditions encountered, and take appropriate health and safety precautions.

10.4.2. Upon receipt of the written notice, the **Owner** will investigate the conditions. If (a) the material is a Hazardous Material that may present a substantial danger and which was not described in the Drawings and/or Specifications, or identified in the Contract Documents as Work under the Contract Documents, and (b) the Hazardous Material was not brought to the site by the **Contractor**, or does not result in whole or in part from any violation by the **Contractor** of any Laws covering the use, handling, storage, disposal of, processing, transport and transfer of Hazardous Materials, the **Owner** shall order a suspension of Work in writing. The **Owner** shall proceed to have the Hazardous Material removed or rendered harmless by negotiating a change in the Work with the **Contractor**, by means of separate contract or as the **Owner** may deem otherwise expedient. In the alternative, the **Owner** shall terminate the affected Work or the Contract for the **Owner's** convenience.

10.4.3. Once the Hazardous Material has been removed or rendered harmless by any of the means outlined in paragraph 10.4.2, the affected Work shall be resumed as directed in writing by the **Owner**. Any determination by the Michigan Department of Health & Humans Services and/or the Michigan Department of Environment, Great Lakes, and Energy (whichever is applicable) that the Hazardous Material has either been removed or rendered harmless shall be binding upon the **Owner** and **Contractor** for the purposes of resuming the Work. If any such incident with Hazardous Material results in Delay not reasonable anticipatable under the circumstances and which is attributable to the **Owner** or **Professional**, the **Owner** will amend the Contract Documents to provide for a corresponding adjustment in Contract Price or Contract Time, or both, made necessary by such Delay.

10.4.4. If the Hazardous Material was brought to the site by the **Contractor**, or results in whole or in part from any violation by the **Contractor** of any Law covering the use, handling, storage, disposal of, processing, transport and transfer of Hazardous Materials or from any other act or omission within its control, the **Contractor** shall bear its proportionate share of the Delay and costs involved in cleaning up the site and removing and rendering harmless the Hazardous Material to the satisfaction of the **Owner**, State and all Political Subdivisions with jurisdiction. If the **Contractor** fails to proceed with due diligence to take appropriate action pursuant to applicable Law and consistent with the **Owner**

requirements, the **Owner** may act accordingly, in which case the **Contractor** shall defend, indemnify, and hold harmless the **Owner** from and against all claims, as construed in paragraph 1.4, arising from the **Owner's** exercise of such appropriate action.

#### 10.5 Incidents with Archaeological Features:

10.5.1. The **Contractor** shall at once notify in writing the **Owner** of any Archaeological Feature deposits that are encountered or unearthed during the execution of the Work. The **Contractor** shall protect the deposits in a satisfactory manner and no further disturbance of the Archaeological Features shall take place until Work is allowed to be resumed in the affected areas.

10.5.2. If the **Owner**, with the advice of the **Professional**, concludes that the Contract Documents require changes because of Archaeological Features encountered, the **Owner** will amend the Contract Documents to provide for any changes in the Work and corresponding adjustment in Contract Price and/or Contract Time made necessary by the changes due to the Archaeological Features encountered and by any resulting Delay which is not reasonably anticipatable under the circumstances, and which is attributable to the **Owner** and/or **Professional**



**10.6 Unit Price Work:**

10.6.1. If the Contract Documents specify Unit Price Work, the Contract Price shall contain the sum of each unit price times its estimated quantity. The **Contractor** shall be responsible for completing, within the Contract Times, one hundred twenty (120%) of the estimated quantities of Specified Unit Price Work and reasonable quantities of Contingent Unit Price Work.

10.6.2. The **Contractor** shall promptly, **before proceeding with any affected Unit Price Work**, deliver a written notice to the **Professional** (a) whenever actual quantities for an item of Specified Unit Price Work differs materially from those estimated and request an adjustment in the estimated quantity, or (b) requesting authorization to provide any or differing quantities of any item of Contingent Unit Price Work. The **Contractor** or the **Owner** shall submit to the other and the **Professional**, a proposal for adjusting that item's unit price and/or the Contract Time. The proposal shall be properly substantiated.

10.6.2.1. Promptly after being notified by the **Contractor**, the **Professional** will evaluate the affected Unit Price Work and provide its determination to the **Owner** and **Contractor**. If the **Owner** adjusts the estimated quantity of Specified Unit Price Work or authorizes any, or any additional, quantities of Contingent Unit Price Work, the **Contractor** shall proceed with that Unit Price Work as directed by the **Professional**. The **Contractor** shall proceed with the Unit Price Work regardless of whether the **Owner**, after conferring with the **Professional** determines that a variation in quantity justifies an adjustment in the unit price, or that the existing unit price is valid for the additional or reduced quantities, or that no adjustment in the Contract Time is warranted. In the event the **Contractor** disagrees with any such determination, the **Contractor** shall deliver a notice of claim and a claim submittal in accordance with the procedures and within the deadlines set forth in Article 15.

10.6.2.2. Any adjusted Unit Price agreed upon by the **Owner** will only apply to the actual quantities above one hundred twenty percent (120%) or to the actual quantities less than eighty percent (80%) of the estimated quantity. For additional quantities over one hundred twenty percent (120%) or reduced quantities below eighty percent (80%) of the estimated quantity, the **Owner** may negotiate a Unit Price with the **Contractor**, or direct a unilateral change as provided by Article 10 or rebid that Work. In no case, however, will a Unit Price change resulting from a reduction in quantity be renegotiated such that the changed Unit Price produces a modified Bid Price for any line item that exceeds the initial Bid Price for that line item.

10.6.3. No adjustment due to quantity variations shall be allowed (a) unless the **Contractor** met the notice requirements of paragraph 10.6.2, (b) to the extent that the Bid Price for a line item will increase due to reduced quantities at a higher unit, (c) for under runs in any quantities of Contingent Unit Price Work, unless the unit price times the estimated quantity exceeds the lesser of \$50,000.00 or two percent (2%) of the Contract Price, or (d) if any unit price increase results in whole or in part from any act or omission within the control of the Contractor (errors in the Contractor's Bid, unbalanced unit prices, etc.).

**10.7 Cash Allowances; Provisionary Allowances:**

10.7.1. The **Contractor** shall obtain the **Professional's** written acceptance before providing materials, equipment or other items covered by a Cash Allowance. Payments under a Cash Allowance shall be on actual costs, and exclude costs for supervision, handling, unloading, storage, installation, testing, etc., which shall be considered to be included within other elements of the Contract Price. Payments within the limits of an Allowance shall exclude Fee and Bond and insurance premiums since these are already included within other elements of the Contract Price.

10.7.2. The **Contractor** shall complete Work covered by Provisionary/Contingency Allowances as approved in writing by the **Owner** and directed by the **Professional**. The Cost of the Work Involved for Work authorized under any Provisionary/Contingency Allowance shall be determined pursuant to Article 11, except those payments within the limits of any Allowance shall exclude Bond and insurance premiums under paragraph 11.8.1.5, since these costs are already included within other elements of the Contract Price.

**10.8 Change Orders; Change Authorizations:**

10.8.1. The terms "Change Order" and "Change Authorization" are defined in Section 00020 Glossary. Further, Division 1 includes prototype Change Order and Change Authorization forms which shall be used by the **Owner** and **Contractor** in connection with modifications to the Contract.

\*10.8.2. A *bilateral* Change Order which does not incorporate a **Contractor** reservation of rights to claim additional adjustments, shall memorialize the **Owner's** and **Contractor's** agreement as to the adjustments in Contract Price and/or Contract Time made by the Change Order. Any such *bilateral* Change Order shall constitute an all-inclusive settlement for all changes, Delay, and costs, whatsoever, and the **Contractor's** signature on the Bulletin and proposal incorporated into that Change Order represents a waiver of all rights to file a subsequent proposal or a claim under Article 15 on account of that Change Order or the Work.

10.8.3. A presumed *bilateral* Change which includes a proposal signed by the **Contractor** with a reservation to claim additional adjustments shall be regarded as a notice of claim as to those adjustments and shall be pursued as provided in Article 15, except as the **Owner** and **Contractor** may otherwise agree.

10.8.4. A Change Order issued by the **Owner** after unsuccessful Contract Price and/or Contract Time negotiations with the **Contractor** and stating the **Owner's** proposed basis for the necessary adjustments in Contract Price and/or Contract Time shall be a *unilateral* Change Order.

10.8.5. The **Owner** will issue Change Orders to amend the Contract Documents for changes in the Work and for any adjustments in Contract Price or Contract Time agreed to in total or in part by both the **Owner** and **Contractor**; or to correspondingly adjust the Contract Price for Work furnished under Cash Allowances, Work completed that was authorized under Provisionary/Contingency Allowances and actual quantities of Unit Price Work. Amounts for Work Involved in a Change Order signed by the **Owner** may be included in subsequent Requests for Payment.

10.8.6. The **Owner** may use Change Authorizations (a) to document agreed-upon minor variations in the Work, and/or (b) to document or order changes in the Work not warranting any adjustment in Contract Price or Contract Time. Examples of the second category include but are not limited to the **Owner's** authorization for drawing payments against a Provisionary/Contingency Allowance or the **Owner's** consent to quantity variations not increasing the Contract Price.

10.8.7. Before, or in conjunction with, the **Professional's** certification of final payment, an appropriate Change Order will be issued, with the **Professional's** advice, to correspondingly adjust the Contract Price for the value of Work furnished under Cash Allowances, Work completed that was authorized under Provisionary/Contingency Allowances and actual quantities of Unit Price Work.

10.8.8. Subject to the provisions of paragraphs 10.8.2 through 10.8.4, it is a requirement of the Contract Documents that all Change Orders duly signed and issued by the **Owner** shall incorporate Bulletins, which are duly signed by the **Contractor**, regardless of whether the **Contractor** uses a reservation of rights.

## ARTICLE 11 CHANGES IN CONTRACT PRICE; CHANGES IN CONTRACT TIME

### 11.1 General Provisions:

11.1.1. Contract Price or Contract Time may be changed only by Change Order duly signed by the **Owner**. Neither Contract Price nor Contract Time may be changed by Change Authorization (subject to the provisions for constructive changes).

11.1.2. **Contractor** proposals for adjusting Contract Price and/or Contract Time shall be due within fifteen (15) Calendar Days after the **Contractor** receives a Bulletin or delivers to the **Owner** a notice of a change or a Delay. Proposals not complying with the requirements of paragraphs 11.1.4 and 11.1.5 shall be returned for resubmission. This turnaround period is of the essence and any Delay in delivering a bulletin or resulting from resubmission of an incomplete Bulletin shall not justify any increase in Contract Price or Contract Time. The **Owner**, in its sole discretion, may extend or shorten the 15-Day period for Bulletin quotations estimated at more than \$250,000 or less than \$25,000.

11.1.3. The **Professional** will review each **Contractor** proposal, and the **Professional** will recommend to the **Owner**, within a reasonable time, whether or not the Bulletin quotation is acceptable. Due to the time required to obtain **Board** and **Director** approvals, a **Contractor** proposal shall be irrevocable for sixty (60) Calendar Days after it is submitted to the **Professional**.

11.1.4. **Contractor** proposals or claims for Work Involved shall detail all affected items of Work, whether increased, revised, added, or deleted, and shall be fully documented and itemized as to (a) individual adds and deducts in Work quantities and labor manhours; (b) corresponding itemized Cost of Work Involved (paragraphs 11.4 through 11.9; and (c) Fee. Proposals or claims including Fee of five percent (5%) for Work Involved of a Subcontractor shall nominate the performing Subcontractor and enclose the Subcontractor's pricing data, if available.

11.1.5. For **Contractor** proposals or claims for adjustments in Contract Price arising from Delays (whether or not such Delays extend any Contract Time or any early completion date), the

**Contractor's** estimates shall be as comprehensive and detailed as may be appropriate to support the proposal or claim. Examples of germane information include labor productivity, labor manpower levels, production data and Progress Schedule revisions.

11.1.6. If the **Contractor's** surety requires notice of any adjustment in Contract Price and/or Contract Time, whether made pursuant to Article 11 or otherwise; any "or equal" material or equipment or substitution approved by the **Professional**; any change within the scope of Article 10; or any other addition, deletion or revision in the requirements of the Contract Documents, whether made by Change Order or Change Authorization, it shall be the **Contractor's** responsibility, and not the **Owner's**, to give notice to the **Contractor's** surety. It is agreed that none of these modifications to the Contract Documents and/or the Work shall invalidate the Agreement.

### 11.2 Changes in Contract Time:

11.2.1. An extension in Contract Time will be justified only to the extent that the **Contractor** demonstrates, with comprehensive and detailed documentation, that the Delay is not reasonably anticipatable under the circumstances, is not caused by act or omission within the control of the **Contractor**, and, furthermore, that the Delay necessarily extends the Work, or portion of the Work in question, beyond the pertinent Contract Time. If the **Owner** determines that the **Contractor's** documentation is insufficient to allow a thorough evaluation of the time extension request, the **Contractor** shall further support the request through a detailed analysis of the Progress Schedule Revision Submittal.

11.2.2. Examples of events that may justify an extension in Contract Time include acts of God or the public enemy; acts of the U.S. Government, the State or a Political Subdivision, each acting in its public capacity (including acts as permitting agency); acts of a Public Utility acting in its public capacity; fires, floods, epidemics, quarantine restrictions; strikes, freight embargoes; unusual weather (unusual in the sense of frequency or severity vis-à-vis the prior five (5) year average); unusually severe shortages of construction materials (considering all feasible sources of supply); Underground Utilities which the Contract Documents, through error or omission, inaccurately show or indicate; Underground Utilities not previously located; objection, for the **Owner's** convenience, to a nominated Subcontractor; Archaeological Features; suspension of Work; changes in the Work, differing site conditions; variation in quantities; and Delay, as provided in this paragraph, of Subcontractors or Suppliers, at any tier, not caused in whole or in part by any act or omission within the control of both the **Contractor** and any such Subcontractors and Suppliers.

11.2.3. If upon evaluation of the **Contractor's** analysis, the **Owner** approves an extension in Contract Time for Delay not caused in whole or in part by any act or omission within the control of the **Owner** and/or **Professional**, the **Owner** shall authorize the necessary adjustment in Contract Time only. If the **Owner** approves an extension in Contract Time for Delay caused in whole or in part by any act or omission within the control of the **Owner** and/or **Professional**, the **Owner** shall authorize the necessary adjustments in Contract Time and Contract Price.

### 11.3 Methods for Making Adjustments in Contract Price:

11.3.1. The method to be used to determine any adjustment in Contract Price shall be selected by the **Owner** from one of the

methods in paragraph 11.3.1.1 through 11.3.1.3, or otherwise shall be limited to the methods in paragraph 11.3.1.4 or 11.3.1.5.

11.3.1.1. If any Work Involved is covered by lump sum prices or unit prices contained in the Contract Documents, those prices shall be used (subject to the terms and conditions of paragraph 10.6 Unit Price Work). In the latter case, the unit prices shall be applied to the quantity of Unit Price Work Involved.

11.3.1.2. If any Work Involved is not covered by lump sum or unit prices contained in the Contract Documents, then application of a lump sum price may be negotiated using the **Contractor's** itemized estimate of the *anticipated* Cost of the Work Involved, as specified in this Article, and a Fee for the Work Involved, as specified in paragraph 11.11.1.

11.3.1.3. If the Work Involved is not covered by the first two methods, the **Owner** may direct the **Contractor** to proceed with the Work Involved on an *actual cost* basis, with or without a guaranteed maximum, based on an itemized breakdown of the *actual* Cost of the Work Involved, as specified in this Article, and a Fee for the Work Involved, as specified in paragraph 11.11.2.

11.3.1.4. If the Work Involved is not covered by the first two methods, the **Owner** may direct the **Contractor** to proceed through a *unilateral* Change Order on a lump sum basis or a not-to-exceed basis, based on the **Professional's** estimate of the anticipated Cost of Work Involved and a Fee for the Work Involved, as specified in paragraph 11.11.1 or 11.11.2.

11.3.1.5. If payment for the Work Involved is to be determined by the Michigan Court of Claims or a AAA arbitration panel, it is agreed by the **Contractor** that the *actual cost and Fee* method in paragraph 11.3.1.3 shall represent the appropriate method for determining such payment.

11.3.2. Items making-up the Cost of the Work Involved shall be allowable to the extent (a) consistent with those prevailing in the Project locality, (b) necessary, reasonable, and clearly allocable to the Work Involved, and (c) limited to labor costs, Subcontract costs, material and equipment costs, construction equipment costs and general conditions costs, as specified in this Article.

#### 11.4 Labor, Subcontract and Material/Equipment Costs:

11.4.1. The Cost of any Work Involved includes the **Contractor's** payroll costs for craft workers resident at the site (through crew foremen) assigned to furnishing and incorporating materials and equipment into the Work Involved. If craft labor manhours exceed those that can be gleaned from the Means Cost Data, or other cost guide acceptable to the **Owner**, the **Contractor** shall provide proper justification, which shall be acceptable to the **Professional**.

11.4.1.1. Payroll costs shall include wages, labor burdens and a factor for field supplies and purchase costs (less market value if not consumed) of tools not owned by the workers. Labor burdens shall be certified by an authorized financial representative of the **Contractor** and may include social security, unemployment taxes, workers' compensation, health and retirement benefits, vacation, and holiday pay. The factor for field supplies and tools (individually valued at less than \$1,000.00) shall not exceed four percent (4%) of the wages without burdens, unless the **Contractor** furnishes detailed data which supports a higher factor. For actual payroll costs, **Contractor** time sheets verified by the **Professional** and/or certified payrolls shall be the only valid Records. For actual payroll

costs under paragraph 11.3.1.5, time sheets shall be valid only if they expressly correlate to the Work Involved and were recorded at that time and/or used for certified payrolls.

11.4.2. The Cost of the Work Involved includes the **Contractor's** costs for the labor costs, (lower tier) Subcontract costs, material and equipment costs and general conditions costs of Subcontractors nominated for the Work Involved. Except for a higher six percent (6%) limit on the factor for field supplies and small tools, the methods for calculating Subcontractors' costs shall be the same as those for **Contractor** costs, except that the term "Subcontractor" shall replace the term "**Contractor**," context permitting. If the **Owner** and **Contractor** agree in advance, the **Contractor** shall obtain detailed quotations and shall nominate at least two (2) Subcontractors, acceptable to both the **Contractor** and **Professional**, for selection by the **Owner**.

11.4.3. The Cost of any Work Involved includes the **Contractor's** costs for materials and equipment, including transportation, storage, and necessary Suppliers' field services. All trade discounts, rebates and refunds and returns from surplus sales that can be realized at the time of pricing shall accrue to the **Owner**, and the **Contractor** shall make arrangements so that they may be obtained. If the Bulletin for the Work Involved *lists* specific Suppliers, the **Contractor** shall obtain written quotations from them and shall nominate one of the *listed* Suppliers to allow a comprehensive review of the proposal by the **Professional**. Invoices segregating items relating to the Work Involved shall be valid Records in support of actual Supplier costs.

#### 11.5 Construction Equipment Costs:

11.5.1. The cost of any Work Involved includes costs for individual construction equipment with replacement value in excess of \$1,000.00. Transportation, loading and unloading, installation, dismantling and removal and shipping costs shall be allowed to the extent required by the Work Involved and reasonable under the circumstances. Equipment costs shall cease when the equipment is no longer needed for the Work Involved. Payroll costs for labor operating the equipment are as specified in paragraph 11.4.1. Equipment costs shall be computed using the same accounting and estimating rules and prices, whether related to added or deleted Work.

11.5.2. When determining actual construction equipment costs (a) under paragraph 11.3.1.3, daily logs of the equipment, operators, and actual usage, verified by the **Professional**, shall be the valid Records; (b) under paragraph 11.3.1.5, such daily Records shall be valid only if developed when any such Work Involved was performed and used for accounting purposes.

11.5.3. Rented (or owned) equipment, idled solely by actions of the **Owner** or **Professional**, shall be paid at the rate for rented equipment (or at fifty percent (50%) of the rate for owned equipment) provided the idle period exceeds what is normal for the equipment and occurs during normal working hours.

#### 11.6 Rented or Leased Construction Equipment:

11.6.1. Construction equipment rented or leased from third parties shall be priced using the rates negotiated between the **Owner** and **Contractor**. If no agreement is reached, those rates listed in the Rental Rate "Blue Book" published by PRIMEDIA Information Inc. of San Jose, Ca, for the region where the Project is

located applicable to the equipment (model number and year) shall be used. For equipment leased or rented on an hourly basis, the rate for second or third shifts shall not exceed fifty percent (50%) of the base rate. Operating costs shall not exceed the hourly operation rate in the Blue Book. Hourly rates for equipment previously in use at the site for a month or longer shall use the monthly rate divided by 176 hours. Equipment previously in use for only one week or not previously in use at the site shall be invoiced to the **Owner** using the following schedule of equipment use:

Less than 8 hours	Hourly Rate
1 Day but less than 7 Calendar Days	Daily Rate
1 week but less than 30 Calendar Days	Weekly Rate
30 Calendar Days or more (when in use)	Monthly Rate

### 11.7 Owned Construction Equipment:

11.7.1. Construction equipment owned by the **Contractor** or rented or leased from lessors associated with or owned by the **Contractor**, shall be priced using the rates negotiated between the **Owner** and **Contractor** based on the **Contractor's** normal accounting practices. If no agreement is reached, the hourly rates in the "Contractor's Equipment Cost Guide," published by PRIMEDIA Information Inc. for the region where the Project is located shall be used. Operating costs shall not exceed the hourly operation rate in the Blue Book. For multiple shifts, rates shall not exceed the shift Work adjustments recommended in the Cost Guide.

### 11.8 General Conditions Costs:

11.8.1. The Cost of any Work Involved may include necessary general conditions costs to the extent those costs increase or decrease on account of, or are directly attributable to, the performance of Work Involved, or are required due to an extension in Contract Time or Delay under paragraph 11.13.5. Categories of general conditions which are allowable under this paragraph (subject to the provisions of paragraph 11.9) include:

11.8.1.1. To the extent agreed to in advance by the **Owner**, payroll costs for the **Contractor's** project manager or construction manager, but not both, for Work activities conducted at the site.

11.8.1.2. Payroll costs for the **Contractor's** superintendent and full-time general foremen, if any are assigned to the Work, for Work Involved performed beyond normal working hours and/or to the extent those costs and subsistence expenses arise solely from an extension in Contract Time or Delay under paragraph 11.13.5.

11.8.1.3. If agreed to in advance by the **Owner**, payroll costs for management personnel resident and working at the site and for workers not covered under paragraph 11.4.1, resident at the site and engaged as support workers (i.e., loading/unloading, clean-up, etc.) to workers covered under paragraph 11.4.1.

11.8.1.4. Costs of office and temporary facilities at the site, including office materials, office supplies, office equipment, minor expenses, utilities, fuel, sanitary facilities, internet, and telephone service at the site, provided those cost arise solely from an extension in Contract Time or Delay under paragraph 11.13.5.

11.8.1.5. Costs of liability insurance premiums for insurance not included within the labor burdens charged under paragraph 11.4.1, and costs of Bond premiums.

11.8.1.6. Costs of consultants not in the direct employ of the **Contractor**, or Subcontractors not covered under paragraph 11.4.2; to the extent authorized by the **Owner** before proceeding with the Work Involved, and provided that those costs are neither covered by paragraph 11.4 nor excluded by paragraph 11.10; and

11.8.1.7. Taxes on the Work Involved, and for which the **Contractor** is liable; and royalty payments and fees for permits and licenses, provided they relate solely to the Work Involved.

### 11.9 Limitations on Allowable Costs:

11.9.1. The **Contractor** shall not include as part of the Cost of any Work Involved any construction equipment costs, small tool costs, or general conditions costs that do not increase on account of, or are not directly attributable to, the furnishing and/or performance of any Work Involved. Examples of such unallowable costs include:

11.9.1.1. Charges for **Contractor's** superintendent, general foremen and management personnel assigned full-time to the Work, if the charges relate to Work Involved which does not extend the Contract Time or cause Delay under paragraph 11.13.5, or to Work Involved not performed beyond normal working hours.

11.9.1.2. Fixed percent mark-ups for construction equipment (as opposed to specific construction equipment costs); or

11.9.1.3. Cost of field supplies and/or small tools solely for extensions in Contract Time or Delay under paragraph 11.13.5.

11.9.2. Changes in Contract Price for extensions in Contract Time or Delay under paragraph 11.13.5 shall exclude any costs that are unaffected or do not relate to the extension in Contract Time or the Delay in early completion. Examples include:

11.9.2.1. Operating costs of construction equipment assigned to the Work for the duration, to the extent used in the incorporation of materials and equipment into the Work, provided the equipment is not subject to increased usage because of the extension in Contract Time or the Delay in early completion.

11.9.2.2. Operating costs plus owned/rental costs of construction equipment brought to the site for a specific activity (crane used for specific lifts, concrete pump used for pours, etc.), provided the equipment is not subject to increased usage because of the extension in Contract Time or the Delay in early completion.

11.9.2.3. Construction equipment and site facilities which are fully paid under the Contract Price for the Work, as awarded.

11.9.3. The **Contractor** shall not include as part of the Cost of any Work Involved acceleration costs incurred, for the **Contractor's** benefit, to make-up Delay which warrant extensions in Contract Time but do not justify increases in Contract Price.

### 11.10 Costs Covered by the Fee for the Work Involved (and not Allowable as Cost of the Work Involved):

11.10.1. **Contractor** administrative costs and home office overhead, whether at the **Contractor's** principal or branch offices, shall not be allowable as elements of the Cost of Work Involved. Rather, those administrative costs and home office overhead shall be non-reimbursable expenses covered by the Fee for the Work

Involved. Examples of administrative costs or home office overhead covered by this provision include, without limitation:

11.10.1.1. Payroll costs and other compensation of executives, general and administrative managers, estimators (except to the extent agreed to in advance by the **Owner**), claim consultants, attorneys, accountants, labor relation coordinators, purchasers, expeditors, and other administrative staff, whether resident at the **Contractor's** principal or branch offices.

11.10.1.2. Payroll costs and other compensation of project managers, construction managers, architects, engineers, schedulers, detailers, safety personnel, clerks, and other administrative staff not resident at the site and who are not part of the **Contractor's** general conditions personnel contingent.

11.10.1.3. Costs of engineers, architects, accountants, consultants, attorneys, and others, in the direct employ of the **Contractor** or otherwise, utilized for services related to a controversy or claim about the acceptability of the Work.

11.10.1.4. Costs incurred in the preparation of Contract Change Orders (whether or not ultimately authorized by the **Owner**), except as otherwise authorized by the **Owner**; and costs incurred in the preparation or filing of claims; and

11.10.1.5. Any interest on the Work Involved, unless otherwise allowed by the Michigan Court of Claims or an arbitration panel; charges for delinquent payments; lost interest on unpaid withholdings; lost profits and lost opportunities; and home office storage and yard facilities.

#### 11.11 Limits on the Fee for the Work Involved:

11.11.1. Any adjustment in Contract Price made by *bilateral* Change Order which stipulates a lump sum price (developed from the **Contractor's** itemized estimate of the *anticipated* Cost of the Work Involved) without incorporating a **Contractor** reservation of rights to claim additional adjustments, shall include a Fee for costs under paragraph 11.10 and for profit, not to exceed the following:

11.11.1.1. For Work Involved to be self-performed by the **Contractor**, the **Contractor's** Fee shall not exceed fifteen percent (15%) of the Cost of the Work Involved. For Work Involved to be performed by any nominated Subcontractor, regardless of tier, the nominated, performing Subcontractor's Fee also shall not exceed fifteen percent (15%) of the Cost of the Work Involved.

11.11.1.2. For Work Involved to be performed by any nominated Subcontractor, the **Contractor's** Fee shall be five percent (5%) of the performing Subcontractor's Cost of the Work Involved, excluding that Subcontractor's Fee. For Work Involved of any nominated lower tier Subcontractor, any corresponding higher tier Subcontractors and the Contractor shall share equally a Fee of five percent (5%) of the performing lower tier Subcontractor's Cost of the Work Involved, excluding the lower tier Subcontractor's Fee.

11.11.2. Any adjustment in Contract Price made by a *bilateral* Change Order (whether based on a *lump sum* or on the *actual cost* of the Work Involved) which incorporates a **Contractor** reservation of rights to claim additional adjustments, shall include a Fee of only two-thirds (2/3) of the Fee otherwise resulting from the application of paragraphs 11.11.1 or 11.11.2.

11.11.3. The credit to be allowed to the **Owner** for any individual change consisting of deletions, or additions and deletions, that yields a negative net Cost of the Work Involved, shall be the amount of the net decrease and, if the negative net Cost of the Work Involved exceeds \$10,000.00, a Fee credit of one-fifth of the Fee resulting from the application of paragraphs 11.11.1.1 through 11.11.1.3 shall be added to that amount.

11.11.4. For any change in the Work combining additions, revisions, and deletions, one single Fee for the Work Involved shall be added to the net Cost of the Work Involved, unless the change in the Work combines self-performed **Contractor** Work and Subcontractor Work, or Work of more than one Subcontractor, or both, in which case separate Fees for the **Contractor** Work and for the Subcontractor Work shall be calculated, as appropriate.

11.11.6. In the event unrelated changes in the Work are grouped in a Bulletin, or included in a claim, and each of the changes yields a net increase or decrease in the Cost of the Work Involved, the combined Fee for the changes in the Work so grouped shall be computed as the sum of the individual Fees otherwise calculated under paragraphs 11.11.1 through 11.11.5.

#### 11.12 Fee for Unabsorbed Home Office Overhead:

11.12.1. It is intended that the Fee for the Work Involved allowed under paragraph 11.11 shall be included with any adjustment in Contract Price for any Cost of Work Involved. However, the Fee under paragraph 11.11.1 shall not be intended to cover unabsorbed home office overhead resulting from an extension of the Contract Time stated in paragraph 4.1.1 of Section 00500 Agreement. When justified under the Contract Documents, Fee for unabsorbed home office overhead shall be calculated as detailed in paragraph 11.12.2.

11.12.2. If an extension of the Contract Time stated in paragraph 4.1.1 of Section 00500 Agreement and an increase in Contract Price for such an extension in Contract Time is justified under the Contract Documents, the **Owner** shall negotiate with the **Contractor** the reimbursement of an amount for the **Contractor's** home office overhead (under paragraph 11.10) that will be or were unabsorbed before the expiration of that Contract Time. Any such reimbursement shall be based on the lesser of: (a) the product of the ratio of the **Contractor's** home office overhead to its contract billings times the Contract Price in paragraph 3.1 of Section 00500 Agreement that remains unbilled on the expiration of that Contract Time, or (b) that amount derived from the Eichleay formula.

#### 11.13 Changes in Contract Time for Early Completion:

11.13.1. The Contract Times specified in paragraph 4.1 of Section 00500 Agreement represent the **Professional's** best estimate of the time required to complete the Work and take into account comparisons with completed work similar in scope and character to the Work and constructed under similar conditions.

11.13.2. Since "time is of the essence" in performing this Contract, any early completion Rev. 0 Progress Schedule considered acceptable by the **Owner** shall be construed as setting forth a corresponding amount of Contract Float, unless the **Contractor** delivers notice of a request for a shortening of the Contract Time within thirty (30) Calendar Days after receiving the **Owner's** written notice of "no objection" to such Rev. 0 Progress Schedule.

11.13.3. If the **Contractor** requests that the Contract Times be shortened to eliminate the Contract Float on any such early completion Progress Schedule, and the **Owner** agrees to the **Contractor's** request, the **Owner** and **Contractor** may negotiate a reduction in the affected Contract Time. Concurrently, the **Owner** will develop a level of liquidated damages appropriate to the revised Contract Time(s) or, if more appropriate under the circumstances, the **Owner** will specify actual damages, applicable from the negotiated, earlier Contract Time to the Contract Time under revision. In such case, the aggregate actual damages shall not exceed the sum liquidated damages that may have resulted from the originally specified liquidated damages. Such agreement shall be memorialized through an appropriate Change Order.

11.13.4. If the **Owner** and **Contractor** are unable to agree to such reduction in the Contract Times, or the **Contractor** rejects the **Owner's** assessment of liquidated or the stipulation of actual damages, or both, the Contract Times in question shall remain unaltered and the early completion Progress Schedule shall be employed as provided in the Contract Documents.

11.13.5. To the extent that the Progress Schedule supports an early completion date, and a Delay extends performance of the Work beyond the **Contractor's** early completion date but not beyond the corresponding Contract Time, if the **Contractor** pursues an increase in Contract Price for such Delay in early completion, the **Owner** shall consider such request, subject to the following: (a) the early completion is reasonably achievable, i.e., includes proper allowances for weather, **Owner** and **Professional** activities, rework and other foreseeable events within the control of the **Contractor**, (b) the Progress Schedule used to support the request is loaded with Activity manpower data, and (c) the adjustment in Contract Price shall equal fifty percent (50%) of the **Contractor's** Delay costs otherwise allowable under this Article.

11.13.6. As a point of emphasis, under these provisions, an increase in Contract Time and an increase in Contract Price equaling the **Contractor's** costs occasioned by the Delay (as opposed to only fifty percent (50%) of the **Contractor's** Delay costs), shall be justified only if the Delay attributable to the **Owner** and/or **Professional** necessarily extends Substantial Completion of the Work, or the portion of the Work having a specified Contract Time, beyond the correspondingly specified Contract Time.

#### 11.14 Access to Records:

11.14.1. The **Contractor** shall maintain and keep and shall require all Subcontractors and Suppliers to maintain and keep, in accordance with generally accepted accounting principles, Records pertaining to the bidding, award and performance of the Work, including, but not limited to payroll and employment Records and all data used in estimating the **Contractor's** Bid and in pricing and negotiating Work covered by any Change Order, Change Authorization, proposal or claim.

11.14.2. For changes payable on an *actual cost* basis, or in the event of any claim, dispute, litigation, audit exception or appeal or termination, the **Owner** and any of the **Owner's** duly authorized representatives shall have access to those Records for the purpose of inspection, audit/review and scanning/copying. The **Contractor** shall provide appropriate facilities for access promptly after receiving a request. The **Owner** and any of its duly authorized representatives shall have the right to interview **Contractor** employees. The **Contractor** shall make employees available on Business Days between 8:00 AM and 4:00 PM, as requested.

11.14.3. Payroll and other employment Records of workers assigned to the site, including apprentices and trainees, maintained to comply with the requirements of this provision, shall contain the name and address of each worker, correct wage classification, rate of pay (including contributions, or costs assumed to provide, for fringe benefits), daily and weekly number of hours worked, deductions made, and actual wages paid. The **Contractor** shall maintain Records that show: (a) the anticipated costs or actual costs incurred in providing such benefits, (b) that the commitment to provide such benefits is enforceable, and (c) that the plan or program is financially responsible and has been communicated in writing to the workers affected.

11.14.4. Access to Records, as prescribed in this paragraph, shall be allowed at any time during the execution of the Work and shall remain in full force and effect for five (5) years after final payment, or termination (in the event of termination), or date of final resolution of any dispute, litigation, audit exception or appeal – whichever event actually applies to this Contract.

#### 11.15 Price Reduction for Defective Cost and Pricing Data:

11.15.1. If at any time during the prosecution of the Work, there is good cause to doubt the **Contractor's** compliance with the Defective Cost and Pricing Data requirements of this paragraph 11.15, the **Owner** shall be entitled to make an appropriate withholding from any payment otherwise owed to the **Contractor**.

11.15.2. Whenever the **Contractor** signs a proposal for a Contract Price or Contract Time adjustment, a Change Order or a claim settlement, the **Contractor** will be deemed to have certified, to the **Contractor's** best knowledge and belief, that the representations made and data submitted in pricing and negotiating the Cost of the Work Involved in that price proposal, Change Order, or claim settlement: (a) were made in good faith and are consistent with the facts, (b) are consistent with the provisions of Articles 10 and 11, and (c) are complete, accurate and current as of the date agreement was reached on the corresponding adjustments in Contract Price and/or Contract Time. This certification shall apply in each and every respect to any Subcontractor and Supplier who signs any cost and pricing data attached to any such a proposal for a Contract Price or Contract Time adjustment, Change Order or claim settlement.

11.15.3. If any adjustment in Contract Price or Contract Time made by any Change Order, claim or dispute settlement was increased by a material and significant amount because the **Contractor**, or any Subcontractor or Supplier, at any tier, made representations or furnished cost or pricing data of any kind that were false, contained math errors or were incomplete, the Contract Price shall be correspondingly reduced by Change Order.

### ARTICLE 12 PROGRESS PAYMENTS; FINAL PAYMENT

#### 12.1 Schedule of Values:

12.1.1. The Schedule of Values shall be approved by the **Professional** and divide the Work into pay items for significant Sections and areas, facilities, or structures, with subtotals for first tier Subcontractors. If required in Division 1, the Schedule of Values shall be supported by a more detailed breakdown allocating the pay items to the Progress Schedule Activities.

12.1.2. The Schedule of Values shall tabulate labor costs, Subcontract costs and material and equipment costs. Labor costs

shall include appropriate sums for construction equipment costs, general conditions costs, administrative costs (paragraph 11.10) and profit, unless separate pay items are itemized for those costs.

\*12.1.3. The Schedule of Values shall include the following close-out pay items: (a) two percent (2%) of the Contract Price for Fire Marshall approval, certificate of occupancy and other code approvals, as specified in the Contract Documents, (b) two percent (2%) of the Contract Price for manufacturer warranties, finalized operating and maintenance documentation, **Owner** training documentation, and test and balance reports, and (c) two percent (2%) of the Contract Price to cover finalized Record Documents.

## 12.2 Requests for Payment:

12.2.1. Once each month, the **Contractor** shall submit to the **Professional** a Request for Payment on the **Owner's** form signed by the **Contractor** certifying Work completed and enclosing all supporting documentation. Each Request for Payment shall certify that all monies owed by the **Contractor** to Subcontractors and Suppliers for which payment previously has been sought has been paid from payments received and include a sworn statement. No Request for Payment shall include amounts for a Subcontractor or Supplier if the **Contractor** does not intend to use the payments requested, when received, to reduce the **Contractor's** outstanding obligations on the Work.

12.2.2. **The State will only disburse payments under this Contract through Electronic Funds Transfer (EFT).** Contractor must register with the State at <http://www.michigan.gov/SIGMAVSS> to receive electronic fund transfer payments. If Contractor does not register, the State is not liable for failure to provide payment. Without prejudice to any other right or remedy it may have, the State reserves the right to set off at any time any amount then due and owing to it by Contractor against any amount payable by the State to Contractor under this Contract.

12.2.3. Payment to the **Contractor**, if approved by the **Owner**, will be made within thirty (30) Calendar Days after the **Owner** receives and approves a certified Request for Payment from the **Professional**. Payment for authorized reimbursable expenses shall be made monthly in the amount incurred before the cut-off date, provided each payment request expense is properly documented in spreadsheet form detailing the information about the request. The **Contractor** will provide a certification in writing that the payment request submittal is true and accurate.

12.2.4. If payment is requested based on materials and equipment stored at the site or at another location agreed to in writing, the Request for Payment also shall be accompanied by (a) consent of surety, (b) a bill of sale, invoice or other documentation warranting that the **Owner** has received the materials and equipment free and clear of all liens, and (c) evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect them and the **Owner's** interests. If the documentation provided by the **Contractor** to comply with the intent of this paragraph is unsatisfactory, the **Owner** shall be entitled to withhold an appropriate amount from that Request for Payment until the **Contractor** provides documentation acceptable to the **Owner**.

12.2.5. The **Contractor** warrants and guarantees that title to all Work, materials and equipment covered by any Request for Payment, whether incorporated in the Work or not, will pass to the **Owner** free and clear of all liens no later than at the time of payment by the **Owner** to the **Contractor**.

## 12.3 Review of Request for Payment; Intent of Review:

12.3.1. Within ten (10) Calendar Days after receipt of a Request for Payment, the **Professional** shall certify to the **Owner** the amount the **Professional** determines to be due or shall return the Request for Payment to the **Contractor** indicating the reasons for withholding certification. Certification shall be based on the **Professional's** review of the Request for Payment and enclosed documentation, On-Site Inspections, and on-site Project representation, if any has been provided. If a Request for Payment is returned to the **Contractor**, the **Contractor** shall make the necessary corrections and resubmit that Request for Payment.

12.3.2. The **Professional's** certification of any Request for Payment constitutes a representation to the **Owner** that the Work has progressed to the point indicated; that to the best of the **Professional's** knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents; and that the **Contractor** is entitled to payment in the amount certified. Any such representation by the **Professional**, however, shall be subject to an evaluation of the Work as a functioning whole before and upon Substantial Completion; to the results of any subsequent tests called for in the Contract Documents; to a final determination of quantities and classifications of Unit Price Work (if any is specified) and to any other qualifications stated in the certification.

12.3.3. In the case of final payment, the **Professional's** certification of final payment and recommendation that the Work is acceptable shall be a further representation that conditions governing final payment to the **Contractor** have been met.

## 12.4 Refusal to Make or to Recommend Payment:

12.4.1. The **Owner** may withhold from any payment an amount based on the **Professional's** refusal to recommend payment or the **Owner's** estimate of the fair value of items entitling the **Owner** to a withholding. Such may include, but not be limited to liquidated damages, claims made against the **Owner** arising out of or related to the Work, payment claims, or failure by the **Contractor** to reimburse the **Owner** any costs the **Owner** is entitled to recover. The **Owner** will give the **Contractor** reasonably prompt written notice supporting such action.

12.4.2. The **Professional** may refuse to recommend all or any part of any payment, or because of subsequently discovered evidence, inspections or tests or the value of the Punch List, nullify all or any portion of any payment previously recommended, as the **Professional** may consider necessary to protect the **Owner** from loss because (a) the Work is Defective or completed Work has been damaged requiring correction or replacement, (b) the Contract Price has been reduced by Change Order, (c) it has been necessary that the **Owner** correct Defective Work or complete Work, (d) reasonable evidence exists that all or a part of the Work will not be completed within the corresponding Contract Time, (e) of the **Contractor's** failure to comply with all material requirements of the Contract, including, but not limited to the failure to submit Progress Schedule Submittals or Record Documents when due, (f) stored materials for which payment has been made or is sought has been determined by the **Professional** to be damaged or missing, (g) amounts are requested for a Supplier which is not the Supplier named in the **Contractor's** completed Section 00440 Schedule of Materials and Equipment or a Supplier approved by the **Professional** through an "or equal" or substitution procedure, or (h) the **Professional** reasonably believes or knows of the occurrence of an event justifying termination for cause.



**12.5 Request for Final Payment:**

12.5.1. The **Contractor** shall complete the Substantial Completion Punch List within the Contract Time and date fixed by the 12.5.2. Upon written notice from the **Contractor** that the **Contractor** considers the entire Work, or a part of the Work for which final payment is specified in the Contract Documents, to be complete and ready for final payment, the **Professional** will make a final completion inspection with the **Owner** and **Contractor** and notify the **Contractor** in writing of all instances of incomplete or Defective Work revealed by the final inspection. The **Contractor** shall immediately undertake all necessary measure to complete Work in the final completion inspection.

12.5.3. The **Contractor** may request final payment after completing the incomplete or Defective Work to the satisfaction of the **Professional** and delivering final operating and maintenance documentation (with revisions made after Substantial Completion), warranties, inspection certificates, Record Documents (with revisions made after Substantial Completion), release of payment claim forms and all other required documents.

12.5.4. The **Contractor's** request for final payment shall enclose evidence of completed operations insurance and affidavit certifying that the insurance coverage will not be canceled, materially changed or renewal refused except as provided in paragraph 7.4.3, and an affidavit certifying that the surety agrees that final payment shall not relieve the surety of any of its obligations under the Performance Bond and Payment Bond. The **Contractor's** request for final payment shall further include (a) a **Contractor's** "Guarantee and Statement" (available from the **Owner**, form DTMB-0437) containing a statement of guaranteed indebtedness acceptable to the **Owner** in the full amount of the Contract Price, or a release of payment claims in the form of a release of liens, or a Bond or other security acceptable to the **Owner** to indemnify the **Owner** against any payment claim, and (b) a list of all pending insurance claims arising out of or resulting from the Work being handled by the **Contractor** and/or its insurer.

**12.6 Final Payment and Acceptance:**

12.6.1. If the **Professional** is satisfied that the Work, or a part of the Work for which separate final payment is specified in the Contract Documents, has been completed and the **Contractor's** other obligations under the Contract Documents have been fulfilled, the **Professional** will, within thirty (30) Calendar Days after receipt of the final payment request, furnish to the **Owner** and **Contractor** the **Professional's** certification of final payment and acceptance. If the **Professional** is not satisfied, the **Professional** will return that request to the **Contractor**, indicating in writing the reasons for not certifying final payment, in which case the **Contractor** shall make the necessary corrections and request that final payment again be considered.

12.6.2. If the **Owner** concurs with the **Professional's** certification of final payment, the **Owner** will, within thirty (30) Calendar Days after receipt by the **Owner** of the **Professional's** certified recommendation of final acceptance, pay the balance of the Contract Price, subject to those provisions governing final payment specified in the Contract Documents. If the **Owner** does not concur with the **Professional's** determination, the **Owner** will return the request for final payment to the **Contractor** indicating in writing the reasons for refusing final payment and acceptance. In that case, the **Contractor** shall make the necessary corrections and shall request that final payment be again considered by the **Owner**. The **Owner's** written determination will be binding upon the **Contractor**, unless

**Professional.** The **Contractor** shall assemble all requisite documentation before requesting final inspection.

the **Contractor** delivers a notice of a claim and a claim Submittal within the deadlines set forth in Article 15.

12.6.3. If final completion of the Work is significantly delayed through no fault of the **Contractor**, the **Owner** may, upon receipt of the **Contractor's** final Request for Payment, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. Payment of the balance due shall be made under the provisions for final payment but shall not constitute a waiver of claims.

12.6.4. The **Owner** shall pay with reasonable promptness any amounts deducted from the final payment, upon resolution of the claims justifying withholding of such monies.

**12.7 Contractor's Continuing Obligation:**

12.7.1. The following does not constitute acceptance of the Work in the event the Work or any Work is not in accordance with the Contract Documents, and therefore does not release the **Contractor** from its obligation to perform and furnish the Work in accordance with the Contract Documents: (a) a certification by the **Professional** of any Request for Payment or final payment; (b) the issuance of a Substantial Completion certificate; (c) any payment by the **Owner** to the **Contractor**; (d) any Partial Use; (e) any act of acceptance by the **Owner** or any failure to do so; (f) any review and approval of a Shop Drawing, sample, test procedure or other Submittal; (g) any review of a Progress Schedule; (h) any On-Site Inspection; (i) any inspection, test or approval; (j) any issuance of a notice of acceptability by the **Professional**; or (k) any correction of Defective Work or any completion of Work by the **Owner**.

**12.8 Waiver of Claims:**

12.8.1. The making and acceptance of final payment do not constitute a waiver by the **Owner** of any rights as to the **Contractor's** continuing obligations under the Contract Documents, nor will it constitute a waiver of any claims by the **Owner** against the **Contractor** still unsettled, or arising from unsettled payment claims, Defective Work appearing after final inspection or failure by the **Contractor** to comply with the Contract Documents or the terms of any special warranties provided by the Contract Documents or by Law.

12.8.2. The making and acceptance of final payment will constitute a waiver of all claims by the **Contractor** against the **Owner**, other than those claims previously made in writing, on a timely basis in accordance with Article 15, and still unsettled.

**ARTICLE 13 OTHER WORK****13.1 Related Work at Site:**

13.1.1. During the period allowed for the furnishing and performance and completion of the Work, the **Owner** may undertake other work at the site with its own forces, or have other work performed at the site by other parties (including, but not limited to contractors or Public Utilities). If the Contract Documents do not note the performance of any such other work, written notice will be given to the **Contractor** before starting that work.



13.1.2. Whenever Work to be performed by the **Contractor** interfaces with other work, the **Contractor** shall coordinate that Work with the interfacing work. Paragraphs 13.2 and 13.3 outline representative duties and responsibilities assumed by the are comparable provisions for the benefit of the **Contractor** in the contracts between those parties and the **Owner**.

### 13.2 Coordination Requirements:

13.2.1. If other work is ongoing concurrently with the Work, the **Contractor** shall afford the responsible party proper and safe access to the site. The **Contractor** shall afford the other party a reasonable opportunity for the handling, unloading and storage of their materials and equipment and for the execution of their work.

13.2.2. If any part of the Work, for proper execution or results, interfaces on the work of the **Owner** or another party, the **Contractor** shall inspect and promptly report to the **Professional** in writing conditions in that work that render it unavailable or unsuitable for proper execution and results. The **Contractor's** failure to do so will constitute an acceptance of such other work as fit and proper for integration with the Work except for latent or non-apparent defects and deficiencies in the other work.

13.2.3. The **Contractor** shall do all cutting, fitting, patching, and interfacing of the Work that may be required to make any part of the Work come together properly and integrate with other work. The **Contractor** shall not cut, excavate, or otherwise alter any other work without prior written consent of the party responsible for such other work. The **Contractor** shall supply, install and/or cause items to be built into interfacing Work, verify dimensions of interfacing Work, and notify the **Professional** of interfacing work that is unsatisfactory for, or prevents satisfactory installation of, any Work. Installation of any Work shall constitute acceptance by the **Contractor** of all previously placed interfacing work.

13.2.4. The **Contractor** shall be responsible for cooperating with the **Professional** fully in the coordination of the **Contractor** Submittals with interfacing submittals of other parties whose work in any way integrates with the Work or vice versa. Any such coordinated Submittal of the **Contractor** shall identify, by specific written notation, Work which integrates with the other work and of which the **Contractor** knows or has reason to know.

13.2.5. If the **Owner** contracts for other work, the **Owner** will have authority and responsibility for coordinating the operations of the **Contractor** and the other work. The **Owner** may delegate the specific authority and responsibility for coordinating the operations of the **Contractor** and of those parties performing the other work to another organization either by provision in Section 00800 Supplementary Conditions or at the pre-construction conference.

### 13.3 Claims Between the Contractor and Other Parties:

13.3.1. If the **Contractor** causes damage to the work or property of others, or if a claim arising out of the **Contractor's** execution of Work is made by another party against the **Contractor**, **Owner** or **Professional**, the **Contractor** shall promptly attempt to settle with that party by agreement or otherwise resolve the claim. The **Contractor** shall in any event, defend, indemnify, and hold harmless the **Owner** and **Professional** from and against all claims, as provided in paragraph 1.4, and/or judgments arising out of or resulting from damage by the **Contractor** to the work or property of others.

**Contractor** under this requirement. Such duties and responsibilities are for the benefit of the parties on the other work to the extent there

13.3.2. If another party causes damage to the Work or property of the **Contractor**, or if the performance of other work results in any claim by the **Contractor**, the **Contractor** shall promptly resolve the issue by agreement or otherwise resolve the claim. The **Contractor** shall not begin any action against the **Owner** (or its departments, agencies, boards, commissions, officers, and employees) or **Professional** (or their consultants, agents or any of their directors, officers, shareholders, agents, or employees), or permit any action against them to be maintained in the **Contractor's** name or for the **Contractor's** benefit before any court or tribunal, which action seeks to impose liability or recover damages from the **Owner** or **Professional** for such claim.

13.3.3. If the **Contractor** becomes involved in settling or otherwise resolving claims and disputes with other parties performing other work from events covered under paragraphs 13.3.1 or 13.3.2, or because of any other similar controversy, including damage to the Work or other work, or a dispute about responsibility for clean-up or any other issue, neither the **Owner** or **Professional** nor any of their respective consultants, agents, directors, shareholders, officers or employees will be involved in any way in such action (unless subpoenaed or ordered by a court). If the **Owner** incurs costs or damages of the types barred by the provisions paragraphs 13.2.1 and 13.2.2, the **Contractor** shall reimburse those costs and damages to the **Owner**.

13.3.4. Except as excluded in paragraph 13.3.5, if any party performing other work causes Delay upon the Work and if, upon a request from the **Contractor**, the **Owner** determines that any such Delay justifies an increase in Contract Price and/or Contract Time, the **Owner** shall amend the Contract Documents to provide the necessary adjustment in Contract Price or Contract Time, or both.

13.3.5. If a party performing other work is granted an extension in a contract time only (on account of Delay not reasonably anticipatable under the circumstances nor caused, in whole or in part, by any act or omission of the other party, the **Owner**, **Professional** or the **Owner's** representative on that other work), and if, upon a request from the **Contractor**, the **Owner** determines that the time extension granted to the other work requires a change in a coterminous Contract Time in the Contract Documents, the **Owner** shall amend the Contract Documents to provide for the necessary change in Contract Time only.

## ARTICLE 14 TERMINATION

### 14.1 Notice Requiring Assurance of Due Performance:

14.1.1. The **Owner** may request the **Contractor** (with copy to the surety) to provide written assurance of due performance if, at any time, any of the following non-conformances occur, any of which, if not corrected, may justify defaulting the **Contractor**:

14.1.1.1. The **Contractor** fails to complete the Work, or a specified part of the Work, within the corresponding Contract Time; fails or refuses to supply sufficient management, supervision, workers, materials, or equipment; or otherwise fails to prosecute the Work, or any specified part of the Work, with the diligence required to comply with the Contract Time(s).

\*14.1.1.2. The **Contractor** persistently disregards the authority of the **Professional** or violates or disregards a provision of the Contract Documents or the Laws of any Political Subdivision with jurisdiction; or

that the **Contractor** has the financial resources necessary to complete the Work within the Contract Time.

14.1.2. Within seven (7) Calendar Days after the **Contractor** receives a notice requiring assurance of due performance, the **Contractor** shall meet with the **Owner** and present the **Contractor's** plan to correct the non-performance with supporting documentation. If the **Owner** determines that the **Contractor's** plan provides adequate assurance of due performance, that determination shall not waive the **Owner's** right to subsequently default the **Contractor** or affect any rights or remedies of the **Owner** against the **Contractor** and/or surety then existing or that may accrue in the future.

#### 14.2 Contractor Default and Termination for Cause:

14.2.1. The **Owner**, after giving the **Contractor** and surety seven (7) Calendar Days' written notice of intent to default, may declare the **Contractor** in default and terminate the services of the **Contractor** for cause upon the occurrence of one or more of the following events:

14.2.1.1. At or after the meeting referred to in paragraph 14.1.2, the **Owner** determines that there is sufficient cause, giving the issues raised, to default the **Contractor**.

\*14.2.1.2. The **Contractor** fails to comply with the Michigan Residency requirements (1984 PA 431, as amended, MCL 18.1241a); or is found to be in violation of Section 4 of 1980 PA 278 concerning unfair labor practices, or any nondiscrimination requirements imposed by Law.

14.2.1.3. The **Contractor** violates or breaches any material provision of the Contract Documents which provides contractually for the for-cause termination or rescission of the Contract or of the **Contractor's** right to complete the Work.

14.2.1.4. A trustee, receiver, custodian, or agent of the **Contractor** is appointed under contract, as opposed to under bankruptcy Law, whose appointment or authority to take over the **Contractor's** property is for the purpose of enforcing a lien against such property or for the general administration of such property for the benefit of the **Contractor's** creditors; or

14.2.1.5. It is determined that gratuities, including, but not limited to entertainment, gifts or donations were given by or on behalf of the **Contractor** to an official, agent, servant, or employee of the **Owner** or **Professional** to secure the Contract or favorable treatment with respect to the awarding or amending or the making of any determination relative to the execution of the Work.

14.2.2. Unless otherwise agreed between the **Owner** and **Contractor**, at the expiration of the seven (7) Day (intent to default) period, the **Contractor** shall immediately stop all Work and proceed in accordance with the **Owner's** instructions. Following receipt, and expiration, of a second seven (7) Day written notice period intended to allow the surety to complete an investigation of the default, the surety shall immediately:

14.1.1.3. The **Contractor** admits in writing, or the **Owner** otherwise establishes, the **Contractor's** inability or refusal to pay the **Contractor's** debts generally as they become due; or in response to the **Owner's** demand, fails to provide adequate, written assurance

14.2.2.1. If approved by the **Owner**, arrange for the **Contractor** to continue with performance and prosecution of the Work to completion; or

14.2.2.2. Undertake to perform and complete the Work, in accordance with the Contract Documents, in place of the **Contractor**, either through the surety's agents or by executing Sub agreements with qualified contractors (excluding the **Contractor** and any of the **Contractor's** affiliates), or both; and

14.2.2.3. If agreed to by the **Owner**, waive the surety's rights set forth elsewhere in this Article, and with reasonable promptness under the circumstances, after investigating in good faith and with due care and diligence, determine the amount for which it may be liable to the **Owner**, and present that determination to the **Owner**. If the **Owner** rejects that amount, the surety shall negotiate a sum acceptable to the **Owner** and promptly pay that amount to the **Owner** in full and with interest from the date the termination of the **Contractor's** services became effective. If the **Owner** rejects the sum determined by the surety, or if the surety fails to negotiate an agreement with the **Owner** on the amount of the surety's liability, the **Owner** shall have full power and authority to default the surety.

14.2.3. If the **Owner** has terminated the **Contractor**, and the surety elects to act under paragraph 14.2.2.2, the **Owner** will determine in good faith the amount necessary to cover the total direct, indirect and consequential costs (including, but not limited to liquidated damages, costs of correcting Work, fees and charges of engineers, architects, attorneys and others and any other costs and damages for which the surety is liable under Section 00610 Performance Bond) that the **Owner** believes it will sustain from that default. The **Owner** will communicate its determination to the surety, and the **Owner** will deduct that amount in its entirety from Requests for Payment under the Contract Documents. Upon completion of the Work, if the unpaid balance of the Contract Price is not sufficient to reimburse the **Owner** for all actual direct, indirect, and consequential costs resulting from the default of the **Contractor**, the surety and **Contractor**, jointly and severally, are liable to the **Owner** for the difference, which they shall pay to the **Owner** promptly.

14.2.4. If the **Owner** has terminated the **Contractor**, and the surety elects to act under paragraph 14.2.2.2, the surety's contract with another contractor makes that contractor a Subcontractor under the Contract, in which case: (a) the provisions of Article 11 shall remain in full force and effect, (b) the methods and criteria to be used to compute the surety's (in lieu of the **Contractor's**) and that contractor's Cost of and Fee for any Work involved shall be limited to those provided in Article 11, and (c) all Work performed by any such contractor pursuant to a Sub agreement with the surety shall be governed by the flow-through requirement in paragraph 5.1.6, the waiver of rights of subrogation provision in paragraph 7.8 and any other requirements of the Contract Documents governing Sub agreements.

14.2.5. If the **Owner** has terminated the **Contractor**, any such termination will not affect any rights or remedies of the **Owner** against the **Contractor** or surety, or both, then existing or that may accrue after termination. All provisions of the Contract Documents that, by their nature, survive final acceptance of the Work shall remain in full force and effect after a termination for cause of the **Contractor** or default of the surety, or both.

14.2.6. The **Owner** may, in its sole discretion, permit the **Contractor** to continue to perform Work when the **Contractor** is in default or has been defaulted. Such decision by the **Owner** shall in no way operate as a waiver of any of the **Owner's** rights under the Contract

#### 14.3 Surety Default:

14.3.1. If upon receipt of a notice of termination for cause, the surety fails to proceed immediately and as provided in paragraph 14.2.2, the **Owner** shall declare the surety in default under Section 00610 Performance Bond in accordance with the terms and conditions of this paragraph.

14.3.1.1. No default of the surety under the Section 00610 Performance Bond shall be declared, however, until the expiration of fifteen (15) Calendar Days after receipt by the surety of an additional written notice from the **Owner** demanding that the surety perform its obligations under Section 00610 Performance Bond.

14.3.2. If the **Owner** declares the surety in default, the **Owner** shall have full power and authority to exclude the surety and **Contractor** from the site, assume any Sub agreements that the **Owner** so selects and take possession of the Work and of all the surety's and **Contractor's** tools, plant and office, and construction equipment at the site (without liability to the surety or **Contractor** for trespass, rent or conversion). The **Owner** will (a) proceed to the full extent that the surety and **Contractor** could have proceeded, (b) incorporate into the Work all materials and equipment stored at the site or elsewhere, and (c) prosecute the Work to completion as the **Owner** may deem expedient. When the **Owner** exercises any of the rights or remedies provided in this paragraph, the **Owner** shall not be required to obtain the lowest price for Work performed.

14.3.3. If the **Owner** has defaulted the surety, any such termination or default will not affect any rights or remedies of the **Owner** against the **Contractor** or surety, or both, then existing or that may accrue after termination. Any retention or payment of monies due the **Contractor** or surety by the **Owner** will not release the **Contractor** or surety from liability. All provisions of the Contract Documents that, by their nature, survive final acceptance of the Work shall remain in full force and effect after a termination for cause of the **Contractor** or default of the surety, or both.

#### 14.4 Termination for Convenience of the Owner:

14.4.1. Upon fifteen (15) Calendar Days' written notice to the **Contractor** and surety, or sooner if reasonable under the circumstances, the **Owner** may, without cause and without prejudice to any other right or remedy it may have, elect to terminate any part of the Work, or the Agreement in whole or in part, as the **Owner** may deem appropriate for its convenience. Upon receipt of any such termination notice, the **Contractor** shall immediately proceed in accordance with any specific instructions, protect and maintain the Work, and make reasonable and diligent efforts to mitigate costs associated with the termination.

14.4.2. In any termination for convenience, the **Contractor** shall be paid for (a) Work completed, in accordance with the Contract Documents, before receipt of the notice of termination, and (b) reasonable termination settlement costs for commitments that had become firm before the termination. The **Contractor** shall not be paid any anticipated and unrealized general conditions costs, administrative expenses, and profit for uncompleted Work. If no agreement can be reached as to reasonable termination costs, the **Owner** will make a determination in writing which shall be final and binding on the **Contractor** unless the **Contractor** delivers notice of

Documents or Section 00610 Performance Bond, nor in the event of a subsequent default, entitle the **Contractor** or surety to continue to perform or prosecute the Work to completion.

a claim and a claim Submittal in accordance with the procedures and within the deadlines set forth in Article 15.

14.4.3. Upon termination for convenience, the **Owner** shall have full power and authority to take possession of the Work, assume any Sub agreements with Subcontractors and Suppliers that the **Owner** selects, and prosecute the Work to completion by contract or as the **Owner** may deem expedient.

14.4.4. If after notice of termination of the services of the **Contractor**, it is determined the **Contractor** was not in default, the termination shall be deemed to have been for the convenience of the **Owner**. In such event the **Contractor** may recover from the **Owner** payment in accordance with paragraph 14.4.2.

#### 14.5 The Contractor May Suspend Work:

14.5.1. In addition to being entitled to earning interest on unpaid Requests for Payment, the **Contractor** may, upon fifteen (15) Calendar Days written notice to the **Owner**, suspend the Work for the **Owner's** convenience if, through no act or fault of the **Contractor**, the **Professional** fails, for thirty (30) Calendar Days, to initiate processing of any Request for Payment or the **Owner** fails, for ninety (90) Calendar Days, to pay the **Contractor** any Request for Payment finally certified by the **Professional** to be due.

14.5.2. Except as specifically provided in paragraph 14.5.1, this provision shall not relieve the **Contractor** of the **Contractor's** obligations to prosecute the Work in accordance with the Progress Schedule and without Delay during any disputes and disagreements with the **Owner**.

### ARTICLE 15 DISPUTES

#### 15.1 Claims Under This Article:

15.1.1. All claims, counterclaims, disputes, and other matters in question between the **Owner** and **Contractor** arising out of or relating to the Contract Documents or the breach thereof, shall be submitted in writing to the **Professional** and otherwise processed and resolved as provided in this Article.

15.1.2. A claim means a written demand or assertion by the **Owner** or **Contractor**, which is properly certified, seeking an adjustment in Contract Price and/or payment of moneys due, an extension or shortening in Contract Time, the adjustment or interpretation of Contract terms, or other relief arising under or relating to the Contract, which becomes a claim or dispute after a written determination by the **Professional** or **Owner** under the appropriate provision of the Contract Documents.

15.1.3. Unless otherwise agreed between the parties, any claim that can be resolved under a provision of the Contract Documents providing for or excluding the relief sought by the claimant shall be resolved in accordance with that provision.

15.1.4. Notice of Claim - Except for **Owner** claims for liquidated damages, no claim shall be valid unless it is based upon written notice delivered by the claimant to the other party promptly, but in no event later than thirty (30) Calendar Days after the **Professional's**

or **Owner's** determination giving rise to the claim. The notice shall include a supporting statement stating the nature of the dispute, the amount involved, if any, and the remedy sought. The claim submittal with all supporting data shall be delivered within sixty (60) Calendar \*15.1.5. A claim by the **Contractor** shall be submitted to the **Professional** and **Owner** for a recommendation or decision from the **Professional** and, if necessary, an **Owner** determination. A claim by the **Owner** shall be submitted to the **Contractor** and the **Professional** for a written recommendation or decision by the **Professional**. The **Owner** reserves the right to audit, using the provisions in paragraph 11.14, any **Contractor** claim (or claim package) that the **Contractor** values at more than \$50,000.00.

15.1.6. Pending final resolution of any claim under this Article, the **Contractor** shall proceed diligently with the Work and comply with any decision of the **Owner** and/or **Professional**

## 15.2 Requirement for Certification of Contractor Claims:

15.2.1. For all **Contractor** claims seeking an increase in Contract Price or Contract Time, the **Contractor** shall submit an affidavit, certifying that the amount claimed accurately reflects any Delay and all costs that the **Contractor** is entitled from the occurrence of the claimed event and that supporting cost and pricing data are current, accurate, complete and represent the **Contractor's** best knowledge and belief. The affidavit shall be executed by an officer or partner of the **Contractor** with proper authority or his/her designee.

## 15.3 Recommendations or Decisions from the Professional:

\*15.3.1. For **Contractor** claims under \$100,000.00, if requested in writing by the **Contractor**, the **Professional** will render a recommendation or decision within thirty (30) Calendar Days after the request and the **Owner** will issue, if necessary, a determination within thirty (30) Calendar Days after the **Professional's** recommendation or decision. For **Contractor** claims exceeding \$100,000.00, the **Professional** will issue its recommendation or decision and the **Owner**, if necessary, will issue its determination, within sixty (60) Calendar Days after completing an audit of the claim, or after deciding not to conduct such an audit or, in the alternative, will notify the **Contractor** of the date when the determination will be made. In the latter case, a final determination will be concluded within sixty (60) Calendar Days from the date of such notification.

\*15.3.2. For **Owner** claims under \$100,000.00, the **Professional** will render a recommendation or decision within thirty (30) Calendar Days of the request. For **Owner** claims over \$100,000.00, the **Professional**, within sixty (60) Calendar Days, will render a recommendation or decision or notify the **Owner** and **Contractor** when such will be rendered.

\*15.3.3. To the extent any **Professional's** decision is to deny a **Contractor** claim or to agree with an **Owner** claim, that decision shall be final and binding on the **Contractor**, without any determination by the **Owner**, unless the **Contractor** files a request for a presentation with the **Director-DCD** within thirty (30) Calendar Days as required by paragraph 15.4.1. Unless a claim is made in accordance with these requirements, it shall be waived.

\*15.3.4. To the extent that any recommendation from the **Professional** is partly or wholly adverse to a claim from the **Owner**, that determination shall be final and binding on both the **Owner** and **Contractor** unless either party files a request for a presentation with the **Director-DCD** as required in paragraph 15.4.1.

Days after the determination giving rise to the claim (unless the **Professional** allows an extension). The responsibility to substantiate claims shall rest with the claimant.

\*15.3.5. To the extent the **Professional** recommends payment of any **Contractor** claim which increases the Contract Price, that recommendation shall be subject to a determination from the **Owner** in a written opinion. In the event any such determination from the **Owner** is partly or wholly adverse to the preceding recommendation from the **Professional**, that determination shall be final and binding on the **Contractor** unless the **Contractor** files suit in the Michigan Court of Claims within thirty (30) Calendar Days after receipt of such determination. Unless a claim is made in accordance with these requirements, it shall be waived.

## 15.4 Determinations by the Director-DCD:

\*15.4.1. If either the **Contractor** or **Owner** is not satisfied with any decision of the **Professional** rendered pursuant to paragraph 15.3.3 or 15.3.4, that party shall, within thirty (30) Calendar Days of receiving that decision, file a written appeal with the **Director-DCD**. If a **Contractor** or **Owner** appeal is timely filed, the claimant shall be entitled to present its claim, unless waived, to the **Director-DCD**, or his/her designee, provided that a claim narrative with complete supporting documentation is delivered to the **Director-DCD**, or his/her designee, within thirty (30) Calendar Days of that party's written notice of appeal.

\*15.4.2. Within thirty (30) Calendar Days after receipt of any such claim narrative, the **Director-DCD**, or his/her designee, shall schedule the time to start the presentations taking into account the dispute's complexity and the urgency of its resolution. Subject to any recognized privilege, discovery shall be available to either party as provided by the **Director-DCD**, and his/her designee, and shall be concluded thirty (30) Calendar Days before the start of the presentations.

\*15.4.3. During the presentations, the **Director-DCD**, or his/her designee, shall hear presentations and receive evidence on the matters in dispute, as supported by the statement of the dispute. The **Director-DCD**, or his/her designee, shall have discretion concerning the allowability of evidence submitted, and shall not be bound to any rules of evidence other than those he/she promulgates.

\*15.4.4. If the right to a presentation is waived or if a presentation is conducted and the dispute remains unresolved, the **Director-DCD**, or his/her designee, at his/her sole option, shall specify in which forum the dispute shall thereafter be conducted by issuing a written determination to the **Contractor** that the dispute if the **Contractor** so elects, be submitted in writing to:

\*15.4.4.1. The Court of Claims maintained by the State of Michigan for the purpose of adjudicating claims against the State or other appropriate court, or

\*15.4.4.2. Arbitration in accordance with the construction industry rules of arbitration of the American Arbitration Association, subject to the provisions of paragraphs 15.5.1 and 15.5.2, unless the parties mutually agree otherwise.

\*15.4.5. The **Director-DCD's**, or his/her designee's, determination on the forum in which the dispute shall be conducted is final and binding upon the **Owner** and **Contractor**. The **Director-DCD's**, or his/her designee's determination on the dispute shall be final and binding on the **Contractor** unless the **Contractor** files a lawful

action in the forum so chosen (Michigan Court of Claims or arbitration) within thirty (30) Calendar Days after receiving the **Director-DCD's**, or his/her designee's, determination.

the Michigan Court of Claims or requests arbitration, and the final determination of either forum does not increase the **Contractor's** recovery by thirty (30%) percent or more above that awarded by the **Director-DCD**, or his/her designee, or voluntarily withdraws the action, the **Contractor** shall pay all resulting expenses of the **Owner** (including, but not limited to reasonable charges of attorneys, engineers, others and court or arbitration costs)

#### **15.5 Supplements to AAA Arbitration:**

\*15.5.1. No arbitration, arising out of, or relating to the Contract Documents shall include, by consolidation, joinder or in any other manner, any additional party not a party to this Contract, except by written consent containing a specific reference to the Agreement and signed by all the parties involved. Consent shall be deemed given by any party who has executed an agreement directly with the **Owner** affected by the Project and containing provisions comparable to those in this Article 15. Any consent to arbitration involving any additional party or parties shall not constitute consent to arbitration of any dispute not permitted in this Article. The agreement to arbitrate with any additional party or parties duly consented to by the parties to this Contract shall be specifically enforceable under the prevailing arbitration Law.

15.5.2. Subject to any recognized privilege, discovery shall be available to each party to the arbitration as it would be available under the general court rules of the Michigan Court of Claims which shall be enforced by the American Arbitration Association. All discovery and amendments to the prehearing summary shall conclude thirty (30) Calendar Days before the arbitration date. Failure to provide the foregoing discovery shall render any claim supported by witnesses or documents not so disclosed excludable by the arbitration panel in its discretion.

\*15.4.6. If, after such determination from the **Director-DCD**, or his/her designee, the **Contractor** properly submits the dispute to

#### **15.6 Interest on a Judgment; Payment of Judgment:**

\*15.6.1. If, subsequent to a determination by the **Director-DCD**, or his/her designee, the **Owner** or **Contractor** files a Michigan Claims Court or AAA arbitration action, and the party filing for such action increases its recovery by thirty (30%) percent or more above that awarded by the **Director-DCD**, or his/her designee, that party shall be entitled to interest calculated in accordance with MCL 600.6013, as amended, whether the action is filed with the Michigan Court of Claims or the American Arbitration Association.

\*15.6.2. After settlement or final adjudication of any claim under this Article if, upon demand, payment by the **Contractor** is not made to the **Owner**, the **Owner** may offset the appropriate amounts against (a) payments due to the **Contractor** under any other contract between the **Owner** and the **Contractor**, or (b) any amounts for which the **Owner** may be obligated to the **Contractor** in any capacity.

#### **15.7 Venue; Flow-Through Provision:**

15.7.1. The **Contractor** agrees to waive jurisdiction and venue, to consent and submit to the jurisdiction of, and not commence any action in other than, a competent State court in Ingham County, Michigan, unless original jurisdiction is vested in the Michigan Court of Appeals, the Michigan Court of Claims, or the Michigan Supreme Court, regardless of residence or domicile, for any action or suit at law or in equity arising out of or under the Contract Documents. The **Contractor** further agrees that it will have each of its Suppliers and Subcontractors provide similar waivers as those required in this paragraph.

15.7.2. The **Contractor** shall insert the provisions of this Article in all Sub agreements, altering those paragraphs only to identify properly the contracting parties.

**END OF SECTION 00700**

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**SECTION 00800 SUPPLEMENTARY CONDITIONS**

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**PROFESSIONAL – WTA Architects**

WORK – Center for Forensic Psychiatry - Create Kitchen

AGENCY No. – 491 FUNDING CODE. 171CODHHS7255 FILE No. 491/20167.SDW

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The provisions of this Section 00800 Supplementary Conditions amend or supplement Section 00700 General Conditions and those other provisions of the Contract Documents, as indicated below. All other provisions of the Contract Documents that are not so amended or supplemented remain in full force and effect.

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**ARTICLE 4 CONTROL OF THE WORK – GENERAL PROVISIONS**

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ADD Section 4.4.14 as follows:

4.4.14 The Contractor shall note and comply with APPENDIX I SPECIAL WORKING CONDITIONS and APPENDIX II SPECIAL PROJECT PROCEDURES as part of and in conjunction with all other contract requirements. APPENDIX I & II immediately follow and are attached hereto SECTION 00800.

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**ARTICLE 7 LEGAL AND CONTRACTUAL REQUIREMENTS; INSURANCE**

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**7.14.4 STATE-FUNDED PROJECT PREVAILING WAGE REQUIREMENTS**

1. The Contractor (and its Subcontractors) represents and warrants that it pays all mechanics and laborers employed directly on the site of the work, unconditionally and at least once a week, and without subsequent deduction or rebate on any account, the full amounts accrued at time of payment, computed at wage rates not less than those stated in the advertised specifications as prevailing wages based on locality, regardless of any contractual relationship which may be alleged to exist between the Contractor or subcontractor and the laborers and mechanics.
2. The Contractor represents and warrants that Contractor will post the scale of wages to be paid in a prominent and easily accessible place at the site of the work.

**\*\*\* Note to the Professional; The Professional should request State Prevailing Wage Provisions from DCD and obtain Wage Determinations applicable for the counties in which the Project is located.**

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**ARTICLE 15 DISPUTES**

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REPLACE Section 15.1.2 with the following:

15.1.2. A claim means a written demand or assertion by the Owner or Contractor, which is properly certified, seeking an adjustment in Contract Price and/or payment of moneys due, an extension or shortening in Contract Time, the adjustment or interpretation of Contract terms, or other relief arising under or relating to the Contract. If a Bulletin or specific request for proposal has been issued by the Professional or Owner and quoted by the Contractor, it may become a claim or dispute with proper written notice per 15.1.2.1 should the Contractor is object to a written determination and/or rejection by the Professional or Owner under the appropriate provision of the Contract Documents.

ADD Section 15.1.2.1 – Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker (Professional/PSC). Claims by either party must be initiated within 21 days after the occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognized the condition giving rise to the claim. Provided such timely notice is delivered, a full and detailed breakdown of cost and time requested, with supporting documentation, if not provided with initial notice shall be delivered to Professional and Owner within 15 days of the notice, as noted in article 11.1.2, unless otherwise agreed in writing, by the Owner prior to expiration of such time.

ADD Section 15.1.2.2 – Pending final resolution of a Claim, except as otherwise agreed in writing or as provided under conditions of failure of timely progress payment or Article 14, the Contractor shall ensure the Work diligently proceeds with the performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Owner shall prepare Change Orders and PSC shall certify payment requests in accordance with the decisions of the Initial Decision Maker.

REPLACE Section 15.1.4 with the following:

15.1.4. Notice of Claim - Except for **Owner** claims for liquidated damages, no claim shall be valid unless it is based upon written notice delivered by the claimant to the other party and the Professional/PSC within 21 days as per 15.1.2 and 15.1.2.1. The notice shall include a supporting statement stating the nature of the dispute, the amount involved, if any, and the remedy sought. The claim submittal with all supporting data shall be delivered within thirty (30) Calendar Days after Notice (unless the **Professional** allows an extension). The responsibility to substantiate claims shall rest with the claimant.

## END OF SECTION 00800

## SECTION 01310 PROGRESS SCHEDULE

### PART 1 - GENERAL

#### 1.01 SUMMARY

A. The **Contractor** will submit CPM Progress Schedules to the **Owner** depicting its approach to prosecution of the Work. This includes but is not limited to the **Contractor's** approach to recovering schedule and managing the effect of changes, substitutions, and Delays on Work sequencing.

B. The Progress Schedule will include the Rev. 0 Submittal (par. 3.02), Update Submittals (par. 3.03) and Revision Submittals (par. 3.04). Each Submittal will be assigned a unique number. For a resubmission, the initial number will be modified by the letter A, B, C, etc., as appropriate.

C. Through the Progress Schedule, the **Owner** will seek to stay current on progress, updated Activity and Milestone Dates, and the **Contractor's** approach to Work remaining.

D. References to the Critical Path Method (CPM) are to CPM construction industry standards that are consistent with the requirements of this Section 01310.

#### 1.02 RELATED SECTIONS

A. Section 00440 Schedule of Materials and Equipment; Section 00500 Agreement; Section 00700 General Conditions; and Section 00800 Supplementary Conditions.

#### 1.03 GLOSSARY OF TERMS

A. Capitalized terms not already defined in any Division 0 Specification have the following intent and meanings:

1. Milestone—A key point of progress, designating interim targets toward the Contract Times. They may pinpoint critical path foundations, key deliveries, building framing, start of MEP rough-in, building enclosure, partitions, interior finishes, conditioned space, commissioning stages, Substantial Completion, and other events of like import.

2. Official Schedule—The most recent Revision Submittal returned to the **Contractor** as Resubmittal Not Required. The Rev. 0 Official Schedule is the *As-Planned* Schedule.

3. Revision 0 Submittal—Progress Schedule submitted by the **Contractor** depicting the entire Work as awarded.

4. Update Submittal—A monthly Progress Schedule update reflecting progress and minor adjustments on the Activities, sequencing and restraints for Work remaining.

#### 1.04 QUALITY ASSURANCE

A. The **Contractor** will obtain a written interpretation from the **Professional**, if the **Contractor** believes the selection of Activities, logic ties or restraints requires an interpretation of the Contract Documents. With each submission, the **Contractor** will point out by specific, written notation, any Progress Schedule feature that may reflect variations from any requirements of the Contract Documents.

B. The **Contractor** is responsible to obtain information from each Subcontractor and Supplier when scoping their respective Activities, Values, logic ties and restraints

C. No review of any Progress Schedule by or on behalf of the **Owner** will relieve the **Contractor** from complying with the Contract Times and any required sequence of Work or from completing Work omitted from the Progress Schedule. No review will imply approval of any variation from or interpretation of the Contract Documents, unless approved by the **Professional** through a written interpretation or by means of a separate, written notation.

#### 1.05 ALLOWANCES

A. Work covered by Cash Allowances will be completed within the Contract Times. To the extent reasonable and consistent with the **Contractor's** plan, Work authorized by contingency allowances will be completed within the Contract Times. The Progress Schedule will incorporate the **Contractor's** best estimate of the Activities, logic and restraints required, using the

information in the Contract Documents, or as indicated by the **Professional** in writing.

### 1.06 "OR EQUALS" AND SUBSTITUTIONS

A. Activities in the Rev. 0 Progress Schedule will be based on materials and equipment required by the Contract Documents and will not reflect any "or equal" or substitute materials or equipment, even if the **Contractor** intends to pursue "or equal" and substitution proposals. This limitation also applies to any Means and Methods indicated in or required by the Contract Documents.

### 1.07 MEASUREMENT AND PAYMENT

A. The Schedule of Values will include a Progress Schedule *pay item*. Fifteen percent (15%) of this *pay item* will be eligible for payment upon delivery of the *complete* Rev. 0 Submittal. The balance of this *pay item* will be eligible for payment, on a prorated basis, with each Request for Payment attaching an Update Submittal.

## PART 2 - WORK PRODUCTS

### 2.01 PROGRESS SCHEDULE SUBMITTALS

A. Each Progress Schedule Submittal will consist of an electronic disk with the **Contractor's** files, a narrative and three (3) copies of the required reports and plots.

B. The CPM scheduling software will be Primavera Project Planner®, SureTrak® or Microsoft Project®.

### 2.02 PRINTOUTS

A. Schedule Reports will include Activity (ID) code and description, duration, calendar, Early Dates, Late Dates and Total Float, all of which will comport with the requirements of paragraph 8.3.4 of Section 00700 General Conditions.

1. Late Finish Date for an Activity pinpointing a Contract Time will equal that Contract Time. Early Start Date for an Activity designating a Contract restraint will equal the proper Notice to Proceed date. Schedule Reports may or may not append CPM Plots (time-scaled Activity/logic).

2. For Precedence Diagram Method, separate Schedule Reports will tabulate, for each Activity, all preceding and succeeding logic types and lead times, whether CPM Plots displaying vertical logic ties are appended or not.

B. CPM Schedule Plots will be plotted on a suitable time scale and identify the Contract Times, Critical Paths, and sub-Critical Paths. Activities will be shown on the Early Dates with Total Floats noted by Late Date flags.

C. Line of Balance Plots will reflect industry practice for repetitive construction and will segregate the production lines for all trades within the hammock Activities.

### 2.03 NARRATIVE REQUIREMENTS

A. In general, a narrative will describe the **Contractor's** approach to prosecution of the Work, subject to the requirements of the Contract Documents. Further, each narrative will list the Critical Path Activities and compare Early and Late Dates with Contract Times and Milestone Dates. The basis for restraint dates will be explained.

## PART 3 – EXECUTION

### 3.01 FLOAT TOLERANCES

B. For each Update Submittal, the narrative will compare current Dates to the respective Milestone Dates, describe changes in crewing and construction equipment and identify new Delays. For each Revision Submittal, the narrative also will itemize changes in Activities, logic ties and restraint dates made necessary by each change, Delay, schedule recovery, substitution and **Contractor**-initiated revision occurring since the previous Submittal.

### 2.04 ACTIVITY REQUIREMENTS

A. The Progress Schedule will detail Work sequencing only to the extent necessary to allow the **Owner** to correlate percent complete, compare actual dates with Milestones and Contract Times and the data in Requests for Payment.

B. Separate Activities will designate permits, construction, Submittal preparation/review (and resubmission and re-review, for same); MEP coordination drawings; deliveries; commissioning; and Punch List. Separate Activities will designate **Owner**-furnished items, interface with other work and the **Owner** and **Professional's** responsibilities.

B. Activities will be detailed only to the extent required to show the transition of trade Work. Activities will detail the progression through site/excavation, foundations, building framing, start/completion of interior partitions, MEP rough-in, building enclosure, interior finishes, conditioned space, and commissioning.

1. Submittal Activities will segregate long-lead items, any item requiring structural access and other procurements that, in the **Contractor's** judgment, may bear on the rate of progress. Separate MEP coordination drawing Activities will be used for each floor. Beyond these requirements, it is not necessary to burden the Progress Schedule with Activities for less significant Submittals and deliveries.

2. For multiunit Work (e.g., rough-in overhead MEP for each floor, etc.), detailed Activities will be shown for a typical (often, the first) unit). Other or follow-on units may be replicated, as appropriate, or modeled with a hammock Activity combining the sum total of the typical detailed Activities. Separate Activities, as may be suitable to the Divisions of Work involved, will be identified for single-unit Work. This requirement applies to such scope as Work in mechanical rooms, building framing, commissioning, etc.

3. Activities will not combine separate or non-concurrent items of Unit Price or lump sum Work, Work in separate structures and Work in distinct areas, locations or floors within an area or structure; or rough-in and finish Work.

C. Activity durations will equal the Business Days required to sufficiently complete the Work designated by the Activity (i.e., when finish-to-start successors may start, even if the Activity is not quite 100% complete). Installation Activities will last from twenty (20) to forty (40) Days.

D. Activities will be assigned consistent descriptions and identification codes. Sort codes will group Activities by building or structure, floor or area, Change Order and Change Authorization and other meaningful scheme

A. Any Progress Schedule with Early Dates after a Contract Time will yield negative Total and Contract Floats, whether shown/calculated or not. Any Revision Submittal with less than negative twenty (20) Days of Float will be returned as "Revise



and Resubmit," unless a time extension is requested, or the **Owner** withholds liquidated damages or asserts intent to do so in the event schedule is not recovered.

B. Floats calculated from the definitions given in Section 00020 Glossary supersede any conflicting Float values calculated within any early completion Progress Schedule.

### 3.02 REVISION 0 (Rev. 0) SUBMITTAL

A. The complete Revision 0 Submittal will be due with the first Request for Payment. The Rev. 0 Submittal will show the Work as awarded, without Delays, "or equal" or substitutions, Change Orders or Change Authorizations.

1. The Rev. 0 narrative will detail the **Contractor's** management of the site (lay down, parking, etc.). Further, the Rev. 0 narrative will identify shifts, weekend Work, Activity calendars, Delays since award and all pending and anticipated "or equal" and substitution proposals.

E. Once endorsed by the **Owner** and returned as "Resubmittal Not Required," the Rev. 0 Progress Schedule (or Rev. 0A, etc.) will be the As-Planned Schedule and the basis for Update Submittals until the Rev. 1 Official Schedule is established. Once the As-Planned Schedule is established, the **Owner** will select Milestones and note Milestone Early and Late Dates. As the Official Schedule evolves, Milestone Dates will be revised accordingly.

F. If the **Owner** refuses to endorse the Rev. 0 Submittal (or Rev. 0A, for a resubmission) as "Resubmittal Not Required," the As-Planned Schedule will not be established. In that event, the **Contractor** will continue to submit Update and Revision Submittals reflecting progress and the **Contractor's** approach to remaining Work. The **Owner** will rely on the available Update and Revision Submittals, subject to whatever adjustments it determines appropriate.

### 3.03 UPDATE SUBMITTALS

A. Update Submittals with progress up to the closing date and updated Early and Late Dates for progress and remaining

Activities will be due with each Request for Payment. As-built data will consist of actual start dates, percent complete, actual finish dates, changes, Delays, and other significant events occurring before the closing date.

### 3.04 REVISION SUBMITTALS

A. Progress Schedule Revisions will be submitted with the third Request for Payment and every two (2) months after that, or more often, if necessary due to schedule recovery or other Progress Schedule revisions. Revisions will revise the Update Submittal attached to the prior Request for Payment.

B. Progress Schedule revisions will detail all impacts on pre-existing Activity scope, logic ties and restraint dates and reflect the Contractor's current approach to Work remaining. Revisions may be required because of changes in the Work, substitutions, schedule recovery and Delays.

C. Once endorsed by the **Owner** and returned as "Resubmittal Not Required," a Revision Submittal becomes the Rev. 1, Rev. 2, etc. Official Schedule and the basis for subsequent Update Submittals until a more current Official Schedule is established. If the **Owner** refuses to endorse a Revision Submittal as "Resubmittal Not Required," the **Contractor** will continue to submit Update and Revision Submittals when and as required in this Section.

### 3.05 RETROSPECTIVE DELAY ANALYSIS

A. If the **Owner** refuses to endorse any Revision Submittal as "Resubmittal Not Required," the **Contractor** and **Owner** will use the latest Official Schedule when evaluating the effect of Delays on Contract Time and/or Contract Price. The procedure will consist of progressively revising the latest Official Schedule at key Revision Submittal closing dates. For each Progress Schedule iteration, slippage between actual Milestone Dates and Rev. 0 Milestone Dates will be correlated to Delays occurring solely in that iteration. Revisions affecting Work after any iteration will be included only to the extent consented by the **Owner** at that time and/or if actually confirmed by as-built progress.

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## END OF SECTION 01310

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This 01310 Specification uses the FORMSPEC™ Section 01310 Model Progress Schedule Specification (CPM Short Form). Title to and use of this Specification is strictly restricted. Except as may be appropriate for use in the bidding and execution of the Work, reproduction, translation or substantial use or quotation of any part of this Specification beyond that permitted by the 1976 United States Copyright Act without prior written permission of PMA Consultants LLC is unlawful.

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**APPENDIX I**

**SPECIAL WORKING CONDITIONS**

## DTMB State Facilities Administration

**DEPARTMENT OF HEALTH AND HUMAN SERVICES (Community Health Facilities)**

The Work comprising this Project will be performed in a hospital for treatment of mentally ill persons and the Contractor must comply with the following special working rules.

1. Contractor must submit a list of names, social security numbers, birth dates, and additional information when requested, on all persons expected to be employed on the Project site. Such list must be submitted directly to the Security Chief's office or to his designee for approval before any person's appearance at the site for Work assignments.
2. Contractor will be allowed to work within or on hospital confines from 8:00 a.m. to 5:00 p.m. No Work must be performed on Saturdays or Sundays without written permission from the State Agency. The Director of Security or their designee may arrange other time schedules.
3. All employees of the Contractor may be subject to individual body search each time they enter the hospital. Packages or containers of any kind may be opened for inspection. Lunch boxes are not permitted inside the security perimeter. All employees of the Contractor will be required to have identification cards or badges furnished by the Contractor.
4. All trucks and other mobile equipment may be subject to inspection both on arrival and departure from the hospital. Absolutely no fraternization between patients and Contractor's employees will be tolerated.
5. No requests for visits with patients will be granted to Contractor's employees except where such visiting originated before award of the Contract.
6. Contractor must follow rules pertaining to security and parking as established by the hospital. Contractor must observe all off-limit restricted areas beyond which no unauthorized personnel may trespass. The Contractor and their workers may not leave the assigned Work areas.
7. All heavy power tools and machinery such as air hammers, acetylene tanks, etc., must be removed from the inside of the security perimeter, through the assigned gate by 4:30 p.m., which is the closing time for the gate. Such heavy equipment as power shovels, compressors, welding machines, etc., can remain inside but must be immobilized in an acceptable manner. Cutting torches and cutting tools in general must be securely locked where and as directed by the State Agency and checked out as needed. No tools, small pipe, copper, or wire must remain on the site overnight unless acceptably locked inside shanties or tool chests.
8. There will be no exchange, loaning or borrowing of tools, equipment or manpower between hospital personnel and the Contractor.
9. The assigned gate through which materials, equipment and vehicles must be transported will be opened upon request between the hours of 8:00 a.m. to 4:30 p.m.
10. Sanitary facilities will be assigned by the hospital for the use of the Contractor's employees.
11. Security personnel may be assigned to the working areas. They may inspect and search areas under construction at any time, including the Contractor's equipment.
12. Areas for employee parking, toolboxes, etc., must be assigned only by hospital authorities. Remove all firearms, weapons, alcoholic beverages, drugs, medicines, or explosives from vehicles before entering hospital property. Lock vehicles when not attended.
13. The Director of this hospital retains the right to revise these "Special Working Conditions" as required to meet hospital needs.
14. The Contractor and her/his workers must not pick up hitchhikers or take anyone off the grounds that do not work for the Contractor.
15. The work comprising this Project will be performed at **Center for Forensic Psychiatry**, and the contractor must comply with the following special working rules:

As a contractor providing services at this facility, the contract specifies that you will adhere to federal regulation(s). Effective January 27, 2022, the COVID-19 Health Care Staff Vaccination rule from the Centers for Medicare & Medicaid Services (CMS) requires all contractors and subcontractor employees to show proof of a COVID-19 vaccination or request and be granted a reasonable accommodation by March 28, 2022.

For the purposes of this regulation, **staff** is considered anyone who works or volunteers at the facility this project is located, regardless of clinical responsibility or member contact as staff; this includes your staff.

The Department of Technology, Management & Budget will be required to validate and track the COVID-19 vaccination status of all staff. Contractors will be asked to submit an attestation to the facility that their company is validating and tracking the vaccination status of the individuals that are sent to the facility and that they are compliant with the federal regulation.

Under federal law, staff may be eligible for a medical or religious exemption. These exemptions must meet certain criteria for the exemption to qualify.

- Religious Exemption: Staff with sincerely held religious beliefs may request a religious exemption.
- Objections to the vaccine that are based on social, political, or personal preferences or other non-religious concerns about the vaccine do not qualify for this exemption.
- Medical Exemption: If the immunization is medically contradicted, staff may apply for a medical exemption or delay.
- Staff that request a medical exemption or delay must provide you with a letter signed and dated by a licensed practitioner, who meets the following requirements:
  - a. The licensed practitioner cannot be the individual requesting the exemption
  - b. The practitioner must be operating within their scope and practice as defined by local and state laws.
- The letter must include the following components:
  - a. All information specifying which of the authorized COVID-19 vaccines are clinically contraindicated for the staff member to receive and the recognized clinical reasons for the contraindications.
  - b. A statement recommending that the staff member will be exempted from the facility's COVID-19 vaccination requirements for staff based on the recognized clinical contraindications.

Please note that individuals who are not fully vaccinated will be subject to additional precautions in order to enter and work within the building. These precautions are a risk-based approach to keep our members and staff safe and are dependent on such variables as work area and tasks performed. Staff will be instructed by the facility's leadership as to the additional precautions necessary when working.

Please consider whether your company can attest to following the federal regulation for staff COVID-19 vaccination and return your attestation to the DTMB-DCD Project Director prior to your staff working at the facility. Please continue to track the information required and if the facility is requested to produce proof to a state or federal surveyor, please provide the information as soon as it is requested.

If you would like additional information about the staff COVID-19 vaccination mandate, you can contact the facility's Infection Preventionist or Administrator.

**DEPARTMENT OF HEALTH AND HUMAN SERVICES**

The Work comprising this Project will be performed at a Department of Health and Human Services (DHHS) Facility and the Contractor must comply with the following special working rules:

1. Contractor must submit a list of names, driver's license numbers, birth dates, and additional information when requested, on all persons expected to be employed on the Project site. Such list must be submitted directly to the Superintendent's office or to the Owner Field Representative for approval before any person's appearance at the site for Work assignments.
2. Contractor will be allowed to work within or on State Agency confines from 7:00 a.m. to 6:00 p.m., Monday through Friday only. No Work must be performed outside these hours without written permission from the State Agency.
3. All employees of the Contractor may be subject to individual body search each time they enter the State Agency confines. Packages or containers of any kind may be opened for inspection. All employees of the Contractor will be required to have identification cards or badges furnished by the Contractor.
4. There must be no fraternization between the State residents and the Contractor's employees. Any attempt by any resident to engage in conversation or interfere in any way with a Contractor's employee must be reported immediately to State Agency staff.
5. No firearms, weapons, explosives, alcoholic beverages, drugs, or medicines may be brought into the confines of the Agency.
6. Any tools or material left within the confines of the State Agency overnight must be in locked cabinets, locked rooms or otherwise secured.
7. There will be no exchange, loaning or borrowing of tools, equipment, or manpower between DHHS personnel and the Contractor.
8. Sanitary facilities will be assigned by the State Agency for the use of the Contractor's employees, and it must be the responsibility of the Contractor to keep said sanitary facilities in clean and neat condition.
9. Contractor must follow rules pertaining to foot and vehicle traffic as established by the State Agency. Contractor must observe all off-limit restricted areas beyond which no unauthorized personnel may trespass. The Contractor and his workmen may not leave the assigned Work areas.
10. Security staff may be assigned to the work areas. They may inspect and search areas under construction at any time, including the Contractor's equipment.
11. Keys to certain doors may be assigned to the Contractor. Such doors must be kept locked at all times.
12. The Superintendent of the State Agency reserves the right to revise these rules as required to meet the security needs of the Agency.

**APPENDIX II**  
**SPECIAL PROJECT PROCEDURES**

## SOIL EROSION AND SEDIMENTATION CONTROL PROJECT PROCEDURES FOR CONTRACTORS ON DTMB OWNED AND MANAGED PROPERTIES

1. Comply with Part 91, Soil Erosion and Sedimentation Control of the Natural Resources and Environmental Protection Act 1994 PA 451, as amended.
2. Contact the DTMB, SFA, Design and Construction Division to discuss the implementation of soil erosion and sedimentation control (SESC) on the Project with DTMB SESC Officer. Phone (517) 388-3045 or Email [DTMB-SESC@michigan.gov](mailto:DTMB-SESC@michigan.gov).
3. Following the award of a contract, the Contractor will be required to prepare and issue for approval an SESC Implementation Plan, which indicates the Contractor's intended implementation of SESC on the project including a schedule and sequence. The Environmental Health and Safety Section, upon approval of the implementation plan, will issue to the Contractor an "Authorization to Proceed with Earth Change" document, which is to be posted at the job site. This document is issued in lieu of a permit from the county. Earthwork shall not begin prior to the issuance of this Authorization. Upon receipt of the Authorization document, the Contractor may begin earth change activities.
4. See below the "Checklist for Contractor's SESC Implementation Plan" for details of the required information necessary for the Contractor to create the SESC Implementation Plan. The intent of this plan is to ensure that the Contractor has reviewed and understands the SESC provisions within the plans and specifications.
5. CHECKLIST FOR CONTRACTOR'S SOIL EROSION AND SEDIMENTATION CONTROL IMPLEMENTATION PLAN (For projects that include earth changes or disturb existing vegetation):

DEPARTMENT OF TECHNOLOGY, MANAGEMENT AND BUDGET  
STATE FACILITIES ADMINISTRATION, DESIGN AND CONSTRUCTION DIVISION  
SOIL EROSION AND SEDIMENTATION CONTROL PROGRAM  
P.O. Box 30026, Lansing, Michigan 48909

**PROJECT TITLE: CENTER FOR FORENSIC PSYCHIATRY - CREATE KITCHEN**  
**PROJECT LOCATION: 8303 PLATT ROAD, SALINE, MICHIGAN**  
**PROJECT FILE NUMBER: 491/20167.SDW**  
**INDEX NUMBER: 171CODHHS7255**

Prior to the start of earthwork, the Contractor must submit a Soil Erosion and Sedimentation Control (SESC) Implementation Plan to the Michigan Department of Technology, Management and Budget, Soil Erosion and Sedimentation Control Program. The intent of this plan is to ensure that the Contractor has reviewed and understands the SESC provisions within the plans and specifications. The following checklist will provide Contractors with assistance in creating the SESC Implementation Plan.

The SESC Implementation Plan must include:

1.  A written plan or letter demonstrating:
  - The Contractor's means and methods for the implementation of SESC provisions included within the plans and specifications and compliance with the provisions of Part 91 of PA 451 of 1994, as amended.
  - The Contractor's plan for dust control.
  - The Contractor's plan for inspection and maintenance of temporary SESC's.
2.  A map, location plan, drawing, or amended copy of the Project SESC or grading plan showing:
  - The locations of any stockpiles of soil associated with the Project
  - The temporary SESC controls associated with stockpiles of soil
  - The Contractor's suggested or proposed additions or relocations of any temporary or permanent SESC's. associated with the Project plans and specifications (subject to approval by Engineer and DTMB)
  - Location of site entrances, exits and vehicle routes
  - Location of site superintendent's/project manager's site trailer or office (for SESC Inspector check-in)
3.  A schedule for the installation and removal of temporary controls and the installation of permanent soil erosion and sedimentation controls in relation to the overall construction schedule.

Submit the above items to the above address.

Upon approval of the Contractor's plan, an "Authorization to Proceed with Earth Change" will be issued by DTMB, Design and Construction Division

## DEMOLITION/REMODELING PROJECT PROCEDURES

Furnish all equipment, materials, labor, and services necessary to complete all building demolition required in connection with the existing building, in order to permit the installation of new Work. The goal of the Owner is to generate the least amount of waste or debris possible. However, inevitable waste and debris that are generated shall be reused, salvaged, or recycled, and disposal in landfills shall be minimized to the extent economically feasible. The Contractor will be required to prepare waste management plan for the collection, handling, storage, transportation, and disposal of the waste generated at the construction site for the Owner's review and approval. The Contractor will be required to produce waste management progress reports.

1. Locations: Notations are made in various places on the Drawings to call attention to building demolition which is required; however, these Drawings are not intended to show each and every item to be removed. The Contractor and the Subcontractors for the various trades must remove the materials related to their respective trades as required to permit the construction of the new Work as shown.
2. Permits: The Contractor must secure from the appropriate agencies all required permits necessary for proper execution of the work before starting work on the project site. All fees for securing the permits must be paid by the Contractor, including all inspection costs which may be legally assessed by the Bureau of Construction Codes in accordance with the authority granted under the Public Act 1980 PA 371, as amended.
3. Enclosures: Where it is necessary to make alterations to walls, floors or roof of the existing building, the Contractor must provide and maintain dustproof partitions to separate the parts where Work is being done from the adjoining parts occupied by the State Agency. Where any parts are opened and exposed to the elements, the Contractor must provide weather tight enclosures to fully protect the structure and its contents.
4. Waste Management Plan: The management plan must address waste source identification and separation, returns, reuse and salvage, recycling, landfill options, alternatives to landfilling, materials handling procedures and transportation.
5. Preparation: Protect all existing Work that is to remain and restore in an approved manner any such Work that becomes damaged.
  - 5.1 Rubbish and debris resulting from the Work must be removed immediately from the site by the Contractor. However, any recyclable materials must be recycled; the Contractor will be required to use alternatives to landfills for waste disposal such as reuse or recycle of asphalt, bricks, concrete, masonry, plastics, paint, glass, carpet, metals, wood, drywall, insulation, and any other waste materials to the extent practical.
  - 5.2 Unless otherwise specified, the Agency will remove existing furniture, drapery tracks, draperies, window blinds, and other equipment items, which might interfere with the new construction.
6. Coordination: Demolition work, in connection with any new unit of Work, must not be commenced until all new materials required for completion of that new item of Work are at hand.
7. Waste Management Plan Progress Reports: Submit an updated report with the payment requests. The progress reports shall include:
  - a. The amount of waste sent to a landfill, tipping fees paid and the total disposal cost. Include supporting documents such as manifests, weight tickets, receipts and/or invoices.
  - b. Records for each material recycled/reused/salvaged from the project including the amount, date removed from the job site, final destination, transportation cost, recycled materials, and the net cost/ savings.
  - c. Breakdown of waste by type generated to date.
  - d. Recycling/salvage/landfill rates.
  - e. Percent of waste recycled/salvaged to date.



**APPENDIX III**  
**STATE OF MICHIGAN PREVAILING WAGE SCHEDULES**

**State of Michigan**

**Official Request #:** 324

**Requestor:** WTA Architects

**Project Description:** Center For Forensic Psychiatry Kitchen and Dining Additon

**Project Number:** 491/20167.SDW

**Washtenaw County**

**Official Commercial Prevailing Wage Rates for State Funded Projects**

**Issue Date:** 8/1/2023

**Contract must be awarded by:** 10/30/2023

**Page 1 of 31**

<u>Classification</u>		Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name	Description					

**Boilermaker**

BO169		12/13/2021				
Boilermaker			\$72.47	\$107.55	\$142.63	H H H H H H D Y
<b>Apprentice Rates:</b>						
	1st Period		\$53.53	\$79.15	\$104.75	
	2nd Period		\$55.14	\$81.56	\$107.97	
	3rd Period		\$56.73	\$83.94	\$111.15	
	4th Period		\$58.31	\$86.31	\$114.31	
	5th Period		\$59.85	\$88.62	\$117.39	
	6th Period		\$63.03	\$93.39	\$123.75	
	7th Period		\$66.17	\$98.10	\$130.03	
	8th Period		\$69.32	\$102.83	\$136.33	

**Bricklayer**

BR2-14-BSP		11/16/2021				
Brick Masonry, Stone Masonry, Pointing, Caulking and Cleaning			\$62.63	\$81.01	\$99.39	H H H H H H D N
<b>Apprentice Rates:</b>						
	0-749 hours		\$47.93	\$58.96	\$69.99	
	750-1,499 hours		\$49.76	\$61.71	\$73.65	
	1,500-2,249 hours		\$51.60	\$64.47	\$77.33	
	2,250-2,999 hours		\$53.44	\$67.23	\$81.01	
	3,000-3,749 hours		\$55.28	\$69.99	\$84.69	
	3,750-4,499 hours		\$57.12	\$72.75	\$88.37	
	4,500-5,249 hours		\$58.95	\$75.49	\$92.03	
	5,250 hours		\$60.79	\$78.25	\$95.71	

Official Request #: 324  
 Requestor: WTA Architects  
 Project Description: Center For Forensic Psychiatry Kitchen and Dining Additon  
 Project Number: 491/20167.SDW  
 County: Washtenaw

**Official Rate Schedule**  
**Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.**

**Official Commercial Prevailing Wage Rates for State Funded Projects**

**Issue Date: 8/1/2023**

**Contract must be awarded by: 10/30/2023**

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Classification	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name	Description				

**Carpenter**

CA 687 D		12/1/2021			
Diver	4-10s allowed M-Sat; double time due when over 12 hours worked per day		\$74.87	\$96.58	\$118.28
<i>comment</i>	<i>make up day allowed Saturday</i>				X X H X X H H D Y

CA1045		12/1/2021			
Carpet and Resilient Floor Layer, (does not include installation of prefabricated formica & parquet flooring which is to be paid carpenter rate)			\$57.45	\$81.74	\$106.03
					X X H X X X X D N

**Apprentice Rates:**

1st 6 months	\$32.44	\$44.23	\$56.01
2nd 6 months	\$33.17	\$45.32	\$57.47
3rd 6 months	\$35.58	\$48.94	\$62.29
4th 6 months	\$38.01	\$54.12	\$69.21
5th 6 months	\$40.44	\$56.23	\$72.01
6th 6 months	\$42.87	\$59.87	\$76.87
7th 6 months	\$45.30	\$63.52	\$81.73
8th 6 months	\$47.73	\$67.16	\$86.59

CA687Z2		12/1/2021			
Carpenter-4-	10s allowed Monday thru Saturday; double time due anytime when over 12 hours worked per day		\$64.50	\$82.08	\$99.66
					X X H X X H H D Y

**Apprentice Rates:**

1st & 2nd 6 months	\$39.56	\$49.23	\$58.90
3rd 6 months	\$42.34	\$52.89	\$63.44
4th 6 months	\$45.10	\$56.53	\$67.95
5th 6 months	\$47.87	\$60.18	\$72.48
6th 6 months	\$50.64	\$63.83	\$77.01
7th 6 months	\$53.42	\$67.49	\$81.55
8th 6 months	\$56.20	\$71.15	\$86.09

Official Request #: 324

Requestor: WTA Architects

Project Description: Center For Forensic Psychiatry Kitchen and Dining Additon

Project Number: 491/20167.SDW

County: Washtenaw

**Official Rate Schedule**

**Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.**

**Official Commercial Prevailing Wage Rates for State Funded Projects**

**Issue Date: 8/1/2023**

**Contract must be awarded by: 10/30/2023**

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Classification	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name Description					

*comment make up day allowed Saturdays*

CA687Z2P	12/1/2021				
Piledriver 4- 10s allowed Monday thru Saturday; double time due when over 12 hours worked per day		\$64.50	\$82.08	\$99.66	X X H X X H H D Y

**Apprentice Rates:**

1st 6 months	\$39.56	\$49.23	\$58.90
2nd 6 months	\$45.10	\$56.53	\$67.95
3rd 6 months	\$50.64	\$63.83	\$77.01
4th 6 months	\$56.20	\$71.15	\$86.09

*comment make up day allowed Saturday*

**Cement Mason**

BR2-14-CM	11/16/2021				
Cement Mason		\$57.03	\$74.61	\$92.18	H H H H H H D N

**Apprentice Rates:**

0-749 hours	\$44.73	\$56.16	\$67.58
750-11,499 hours	\$46.48	\$58.78	\$71.08
1,500-2,249 hours	\$48.24	\$61.42	\$74.60
2,250-2,999 hours	\$50.00	\$64.06	\$78.12
3,000-3,749 hours	\$51.76	\$66.70	\$81.64
3,750-4,499 hours	\$53.52	\$69.34	\$85.16
4,500 hours	\$57.03	\$74.60	\$92.18

CE514-W	11/29/2021				
Cement Mason		\$52.82	\$74.60	\$96.37	H H D H H H D Y

**Apprentice Rates:**

1st 6 Months	\$34.23	\$46.71	\$59.19
2nd 6 Months	\$36.30	\$49.82	\$63.33
3rd 6 Months	\$38.39	\$52.95	\$67.51
4th 6 Months	\$40.47	\$56.07	\$71.67
5th 6 Months	\$42.54	\$59.18	\$75.81
6th 6 Months	\$44.63	\$62.31	\$79.99

Official Request #: 324  
 Requestor: WTA Architects  
 Project Description: Center For Forensic Psychiatry Kitchen and Dining Additon  
 Project Number: 491/20167.SDW  
 County: Washtenaw

**Official Rate Schedule**  
**Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.**

**Official Commercial Prevailing Wage Rates for State Funded Projects**

**Issue Date: 8/1/2023**

**Contract must be awarded by: 10/30/2023**

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Classification	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name	Description				

**Drywall**

CE514-DF		12/9/2021											
Drywall Finishers			\$51.86	\$67.66	\$83.46	H	H	H	H	H	H	D	Y
	<b>Apprentice Rates:</b>												
	1st period		\$39.22	\$48.70	\$58.18								
	2nd period		\$40.80	\$51.07	\$61.34								
	3rd period		\$43.96	\$55.81	\$67.66								
	4th period		\$48.70	\$62.92	\$77.14								

PT-22-D		8/25/2016												
Drywall Taper	Four 10s allowed Monday-Thursday		\$45.91	\$59.74	\$73.56	H	H	D	H	D	D	D	D	Y
	<b>Apprentice Rates:</b>													
	First 3 months		\$32.08	\$38.99	\$45.90									
	Second 3 months		\$34.85	\$43.14	\$51.44									
	Second 6 months		\$37.62	\$47.30	\$56.98									
	Third 6 months		\$40.38	\$51.44	\$62.50									
	4th 6 months		\$41.76	\$53.51	\$65.26									

*comment make up day allowed*  
 Friday make-up day for bad weather or holidays

**Electrician**

EC-252-IW		1/10/2022												
Inside wireman			\$73.14	\$97.38	\$121.62	H	H	D	H	D	D	D	D	N
	<b>Apprentice Rates:</b>													
	1st Period		\$41.50	\$57.63	\$73.75									
	2nd Period		\$47.34	\$59.46	\$71.58									
	3rd Period		\$52.52	\$67.07	\$81.62									
	4th Period		\$57.67	\$74.64	\$91.61									
	5th Period		\$62.82	\$82.22	\$101.61									
	6th Period		\$67.99	\$89.81	\$111.62									

Official Request #: 324  
 Requestor: WTA Architects  
 Project Description: Center For Forensic Psychiatry Kitchen and Dining Additon  
 Project Number: 491/20167.SDW  
 County: Washtenaw

**Official Rate Schedule**  
**Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.**

**Official Commercial Prevailing Wage Rates for State Funded Projects**

**Issue Date: 8/1/2023**

**Contract must be awarded by: 10/30/2023**

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Classification Name Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
EC-252-SC	1/7/2022				
Sound and Communications Installer Technician BICSI certified & 6,000 OJT and Half \$73.16 Double Time \$91.99		\$51.10	\$66.96	\$83.79	H H D H D D D D N
		<b>Apprentice Rates:</b>			
		Period 1	\$33.56	\$40.49	\$48.72
		Period 2	\$35.31	\$43.02	\$52.07
		Period 3	\$37.07	\$45.56	\$55.43
		Period 4	\$38.82	\$48.11	\$58.80
		Period 5	\$40.57	\$50.63	\$62.14
		Period 6	\$44.09	\$55.70	\$68.85
		Period 7	\$47.59	\$60.76	\$75.56
		Period 8	\$49.34	\$63.29	\$78.92
		Technician BICSI certification & 6,000 OJT	\$54.32	\$73.16	\$91.99

**Elevator Constructor**

EL-85	11/30/2021				
Elevator Constructor Mechanic		\$96.72		\$152.57	D D D D D D D D Y
		<b>Apprentice Rates:</b>			
		1st year	\$68.96		\$99.68
		2nd year	\$74.88		\$111.18
		3rd year	\$77.85		\$116.95
		4th year	\$84.65		\$129.33

*comment*

4 tens allowed M-TH

Official Request #: 324

Requestor: WTA Architects

Project Description: Center For Forensic Psychiatry Kitchen and Dining Additon

Project Number: 491/20167.SDW

County: Washtenaw

**Official Rate Schedule**

**Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.**

**Official Commercial Prevailing Wage Rates for State Funded Projects**

**Issue Date: 8/1/2023**

**Contract must be awarded by: 10/30/2023**

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<u>Classification</u>	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name Description					

**Glazier**

GL-357	12/9/2021				
Glazier If 4 10 hour day workweek is scheduled, four 10s must be consecutive, M-F.		\$53.55	\$70.10	\$86.65	H H H H H H D Y

**Apprentice Rates:**

1st 6 months	\$37.00	\$45.27	\$53.55
2nd 6 months	\$37.75	\$46.40	\$55.05
3rd 6 months	\$41.97	\$52.73	\$63.49
4th 6 months	\$43.62	\$55.21	\$66.79
5th 6 months	\$45.27	\$57.68	\$70.09
6th 6 months	\$46.93	\$60.17	\$73.41
7th 6 months	\$48.59	\$62.66	\$76.73
8th 6 months	\$51.89	\$67.61	\$83.33

**Heat and Frost Insulator**

AS25	6/3/2016				
Heat and Frost Insulators and Asbestos Workers 4-10s must be worked a minimum of 2 weeks consecutively, Monday thru Thursday. Hours worked in excess of 10 will be paid at double time. Hours worked on the fifth day, Monday thru Friday @ time and half		\$62.65	\$78.41	\$94.16	H H H H H H D Y

**Apprentice Rates:**

1st Year	\$46.90	\$54.78	\$62.66
2nd Year	\$50.05	\$59.50	\$68.96
3rd Year	\$53.20	\$64.23	\$75.26
4th Year	\$56.35	\$68.96	\$81.56

*comment*

Four 10s must be worked for a minimum of 2 consecutive weeks. OVERTIME is different on a four 10 week. OT is 2x for hours beyond 10. All hours on fifth day, M-F require time and one half. Sat first 8 hours, 1.5, all hours after 8 require double time.

Subdivision of county

Twps of Ann Arbor, Augusta, Lodi, Northfield, Pittsfield, Salem, Saline, Scio, Superior, Webster, Ypsilanti and York

AS25S	6/2/2016				
Spray Insulation		\$25.29	\$36.51		X X X H H H H H N

Official Request #: 324

Requestor: WTA Architects

Project Description: Center For Forensic Psychiatry Kitchen and Dining Addition

Project Number: 491/20167.SDW

County: Statewide

**Official Rate Schedule**

**Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.**

**Official Commercial Prevailing Wage Rates for State Funded Projects**

**Issue Date: 8/1/2023**

**Contract must be awarded by: 10/30/2023**

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<u>Classification</u>		Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name	Description					

**Heat and Frost Insulator and Asbestos Worker**

AS47		12/20/2021				
Heat and Frost Insulators and Asbestos Workers			\$52.00	\$68.89	\$85.77	X X X H H H D Y

**Apprentice Rates:**

1st year	\$26.38	\$33.69	\$40.99
2nd year	\$30.15	\$38.92	\$47.68
3rd year	\$33.92	\$44.15	\$54.37
4th year	\$37.70	\$49.39	\$61.08
5th year	\$41.48	\$54.63	\$67.78

*comment make up day allowed*  
Friday for cancelled work in a 4 10 schedule

Subdivision of county      Bridgewater, Dexter, Freedom, Lima, Lindon, Manchester, Sharon and Sylvan

**IBEW 252**

EC-252-sc						
Installor Technician						H H H      D N

**Apprentice Rates:**

Period 1	\$33.56	\$40.49	\$48.72
Period 2	\$35.31	\$43.02	\$52.07
Period 3	\$37.07	\$45.56	\$55.43
Period 4	\$38.82	\$48.11	\$58.80
Period 5	\$40.57	\$50.63	\$62.14
Period 6	\$44.09	\$55.70	\$68.85
Period 7	\$47.59	\$60.76	\$75.56
Period 8	\$49.34	\$63.29	\$78.92
Technician BICSI certification & 6,000 OJT	\$54.32	\$73.16	\$91.99

Official Request #: 324

Requestor: WTA Architects

Project Description: Center For Forensic Psychiatry Kitchen and Dining Additon

Project Number: 491/20167.SDW

County: Washtenaw

**Official Rate Schedule**

**Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.**



**Official Commercial Prevailing Wage Rates for State Funded Projects**

**Issue Date: 8/1/2023**

**Contract must be awarded by: 10/30/2023**

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<u>Classification</u>	Name	Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
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**Ironworker**

IR-25-RF		12/16/2021					
Reinforced Iron Work			\$63.59	\$92.70	\$121.81	H H D H D D D D N	

**Apprentice Rates:**

Level 1			\$47.70	\$68.81	\$89.91	
Level 2			\$48.76	\$70.40	\$92.03	
Level 3			\$51.49	\$74.50	\$97.49	
Level 4			\$54.22	\$78.59	\$102.95	
Level 5			\$56.93	\$84.77	\$112.62	
Level 6			\$58.46	\$84.95	\$111.43	

*make up day allowed*

IR-25-RIG		12/16/2021					
Rigging Work			\$70.50	\$101.32	\$132.14	H H H H H H H D N	

**Apprentice Rates:**

Level 1 & 2			\$45.08	\$64.21	\$83.34	
Level 3			\$47.97	\$68.55	\$89.12	
Level 4			\$50.88	\$72.92	\$94.94	
Level 5			\$53.77	\$77.24	\$100.72	
Level 6			\$56.69	\$84.41	\$112.12	
Level 7			\$59.57	\$85.95	\$112.32	
Level 8			\$62.49	\$90.33	\$118.16	

Official Request #: 324  
 Requestor: WTA Architects  
 Project Description: Center For Forensic Psychiatry Kitchen and Dining Additon  
 Project Number: 491/20167.SDW  
 County: Washtenaw

**Official Rate Schedule**  
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**Official Commercial Prevailing Wage Rates for State Funded Projects**

**Issue Date: 8/1/2023**

**Contract must be awarded by: 10/30/2023**

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<u>Classification</u>	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name    Description					

IR-25-STR	12/22/2021				
Structural, ornamental, welder and pre-cast If bad weather, Friday may be a make up day. If holiday celebrated on a Monday, 4 10s may be worked Tuesday thru Friday.		\$70.57	\$102.45	\$134.32	H H H H H H D D Y

**Apprentice Rates:**

Levels 1 & 2		\$43.60	\$61.99	\$80.38
Level 3		\$46.49	\$66.33	\$86.16
Level 4		\$49.40	\$70.70	\$91.98
Level 5		\$52.29	\$78.28	\$104.38
Level 6		\$55.21	\$79.41	\$103.60
Level 7		\$58.09	\$83.73	\$109.36
Level 8		\$61.01	\$90.89	\$120.76

*make up day allowed*

**Laborer**

L499-A	11/29/2021				
Journey person - building and heavy construction craft laborer, portable concrete mixer operator, air, electric or gasoline tool operator, hot dope carrier, tar kettle tender, gasoline vibrators, concrete gas buggies, concrete saw, signal person and top pe		\$44.91	\$57.84	\$70.77	X X H H H H H D Y

**Apprentice Rates:**

0-1,000 hours		\$38.45	\$48.15	\$57.85
1,001-2,000 hours		\$39.74	\$50.09	\$60.43
2,001-3,000 hours		\$41.03	\$52.02	\$63.01
3,001-4,000 hours		\$43.62	\$55.91	\$68.19

*comment    make up day allowed*  
Saturday

L499-A-A	7/28/2023				
Laborer, Wall and ceiling material handler, plasterer tender, mortar mixer and plastering machine operator		\$47.80	\$63.10	\$78.40	X X H H H H H D Y

**Apprentice Rates:**

0-1,000 hours		\$40.81	\$55.70	\$70.58
1,001-2,000 hours		\$42.12	\$57.66	\$73.19
2,001-3,000 hours		\$43.43	\$59.62	\$75.81
3,001-4,000 hours		\$46.04	\$63.54	\$81.04

Official Request #: 324

Requestor: WTA Architects

Project Description: Center For Forensic Psychiatry Kitchen and Dining Addition

Project Number: 491/20167.SDW

County: Washtenaw

**Official Rate Schedule**

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**Official Commercial Prevailing Wage Rates for State Funded Projects**

**Issue Date: 8/1/2023**

**Contract must be awarded by: 10/30/2023**

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Classification Name	Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
<hr/>						
	<i>comment make up day allowed</i> Saturday					
<hr/>						
L499-A-B		11/29/2021				
	Mortar mixer, material mixer, air, gas or electric tool operator, power buggy operator, stone setter, tender, scaffold builder or dismantler, winlass operator, tar & kettle operator.		\$45.12	\$58.16	\$71.19	X X H H H H H D Y
	<b>Apprentice Rates:</b>					
	0-1,000 hours		\$38.60	\$48.37	\$58.15	
	1,001-2,000 hours		\$39.91	\$50.34	\$60.77	
	2,001-3,000 hours		\$41.21	\$52.29	\$63.37	
	3,001-4,000 hours		\$43.82	\$56.21	\$68.59	
	<i>comment make up day allowed</i> Saturday					
<hr/>						
L499-A-B2		11/29/2021				
	Jack hammering and chipping on concrete		\$45.45	\$58.65	\$71.85	X X H H H H H D Y
	<b>Apprentice Rates:</b>					
	0-1,000 hours		\$38.85	\$48.75	\$58.65	
	1,001-2,000 hours		\$40.17	\$50.73	\$61.29	
	2,001-3,000 hours		\$41.49	\$52.71	\$63.93	
	3,001-4,000 hours		\$44.13	\$56.67	\$69.21	
	<i>comment make up day allowed</i> Saturday					
<hr/>						
L499-A-C		11/29/2021				
	Crock or pipe laborer, caisson worker		\$45.26	\$58.37	\$71.47	X X H H H H H D Y
	<b>Apprentice Rates:</b>					
	0-1,000 hours		\$38.71	\$48.54	\$58.37	
	1,001-2,000 hours		\$40.02	\$50.51	\$60.99	
	2,001-3,000 hours		\$41.33	\$52.47	\$63.61	
	3,001-4,000 hours		\$43.95	\$56.40	\$68.85	
	<i>comment make up day allowed</i> Saturday					
<hr/>						

Official Request #: 324

Requestor: WTA Architects

Project Description: Center For Forensic Psychiatry Kitchen and Dining Additon

Project Number: 491/20167.SDW

County: Washtenaw

**Official Rate Schedule**

**Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.**

**Official Commercial Prevailing Wage Rates for State Funded Projects**

**Issue Date: 8/1/2023**

**Contract must be awarded by: 10/30/2023**

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Classification Name Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
=====					
L499-A-D Watchmen, Civil Engineer Helpers, or Rodmen	11/29/2021	\$44.03	\$56.52	\$69.01	X X H H H H H D Y
<b>Apprentice Rates:</b>					
0-1,000 hours		\$37.79	\$47.16	\$56.53	
1,001-2,000 hours		\$39.03	\$49.02	\$59.01	
2,001-3,000 hours		\$40.28	\$50.89	\$61.51	
3,001-4,000 hours		\$42.78	\$54.65	\$66.51	
<i>comment</i> <i>make up day allowed</i> Saturday					
-----					
L499-A-E Final cleaning: washing or cleaning of walls, partitions, ceilings, windows, bathrooms, kitchens, laboratories and all fixtures and facilities therein. Clean-up mopping, washing, waxing and polishing or dusting of all floors or areas.	11/29/2021	\$41.62	\$52.91	\$64.19	X X H H H H H D Y
<i>comment</i> <i>make up day allowed</i> Saturday					
-----					
MITA-RZ1-C1 Laborer Road Class 1: asphalt shoveler or loader, yard man, fence erector tender, dumper, joint filling, form setting, form stripper, pavement reinforcing, waterproofing, seal coating, bridge painting, sandblasting, pressure grouting, RC equipment	1/5/2022	\$44.32	\$59.58	\$74.84	H H H H H H H D Y
<b>Apprentice Rates:</b>					
3,001-4,000 hours		\$43.02	\$57.64	\$72.24	
2,001-3,000		\$40.41	\$53.72	\$67.02	
1,001-2,000 hours		\$39.11	\$51.77	\$64.42	
0-1,000 hours		\$37.80	\$49.80	\$61.80	
-----					
MITA-RZ1-C2 Laborer Road Class 2: mixer operator, air or electric tool operator, spreader, boxman, concreter paddler, power chain saw operator, paving patch truck dumper, tunnel mucker, concrete saw operator, dry pack machine and roto-mill grounds person	1/5/2022	\$44.45	\$59.78	\$75.10	H H H H H H H D Y
<b>Apprentice Rates:</b>					
3,001-4,000 hours		\$43.14	\$57.82	\$72.48	
2,001-3,000 hours		\$40.52	\$53.88	\$67.24	
1,001-2,000 hours		\$39.21	\$51.92	\$64.62	
0-1,000 hours		\$37.90	\$49.96	\$62.00	
=====					

Official Request #: 324

Requestor: WTA Architects

Project Description: Center For Forensic Psychiatry Kitchen and Dining Addition

Project Number: 491/20167.SDW

County: Washtenaw

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Classification Name      Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
-----					
MITA-RZ1-C3 Laborer Road Class 3: tunnel miner, finish tenders, guard rail builder, median barrier installer, earth retention barrier and wall installer, fence erector, bottom man, powder man, wagon drill and air track operator, curb and side rail setter	1/5/2022	\$44.63	\$60.05	\$75.46	H H H H H H D Y
<b>Apprentice Rates:</b>					
3,001-4,000 hours		\$43.31	\$58.07	\$72.82	
2,001-3,000 hours		\$40.67	\$54.11	\$67.54	
1,001-2,000 hours		\$39.35	\$52.13	\$64.90	
0-1,000 hours		\$38.03	\$50.15	\$62.26	
-----					
MITA-RZ1-C4 Laborer Road Class 4: asphalt raker	1/5/2022	\$44.71	\$60.17	\$75.62	H H H H H H D Y
<b>Apprentice Rates:</b>					
3,001-4,000 hours		\$43.39	\$58.19	\$72.98	
2,001-3,000 hours		\$40.74	\$54.22	\$67.68	
1,001-2,000 hours		\$39.42	\$52.24	\$65.04	
0-1,000 hours		\$38.09	\$50.24	\$62.38	
-----					
MITA-RZ1-C5 Laborer Road Class 5: pipe layers, oxy-gun	1/5/2022	\$44.92	\$60.48	\$76.04	H H H H H H D Y
<b>Apprentice Rates:</b>					
3,001-4,000 hours		\$43.59	\$58.49	\$73.38	
2,001-3,000 hours		\$40.92	\$54.48	\$68.04	
1,001-2,000 hours		\$39.59	\$52.49	\$65.38	
0-1,000 hours		\$38.25	\$50.48	\$62.70	
-----					

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Classification Name Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
=====					
MITA-RZ1-C6	1/5/2022				
Laborer Road Class 6: line form setter for curb or pavement, asphalt screed checker/screw man on asphalt paving machines		\$45.22	\$60.93	\$76.64	H H H H H H D Y
<b>Apprentice Rates:</b>					
3,001-4,000 hours		\$43.87	\$58.91	\$73.94	
2,001-3,000 hours		\$41.17	\$54.86	\$68.54	
1,001-2,000 hours		\$39.83	\$52.85	\$65.86	
0-1,000 hours		\$38.48	\$50.82	\$63.16	
-----					
MITA-RZ1-C7	1/5/2022				
Laborer Road Class 7: concrete specialist - including finishing and trowling, cast in place or precast by any method		\$46.29	\$62.54	\$78.78	H H H H H H D Y
<b>Apprentice Rates:</b>					
2,001-3,000 hours		\$42.08	\$56.22	\$70.36	
3,001-4,000 hours		\$41.31	\$55.02	\$68.72	
1,001-2,000 hours		\$37.69	\$49.59	\$61.48	
0-1,000 hours		\$36.48	\$47.78	\$59.06	
-----					
MLDC	1/7/2022				
Asbestos & Lead Abatement Laborer 4 ten hour days @ straight time allowed Monday-Saturday, must be consecutive calendar days		\$46.70	\$62.52	\$78.33	H H H X X X D Y
<b>Apprentice Rates:</b>					
Trainee 600 hours +1 year		\$34.07			
-----					
<b>Laborer - Hazardous</b>					
-----					
LHAZ-Z3-A	12/14/2021				
Class A performing work in conjunction with site preparation and other preliminary work prior to actual removal, handling, or containment of hazardous waste substances not requiring use of personal protective equipment required by state or federal regulat		\$44.91	\$64.27	\$83.62	H H H H H H D Y
<b>Apprentice Rates:</b>					
0-1,000 work hours		\$38.45	\$54.58	\$70.70	
1,001-2,000 work hours		\$39.74	\$56.52	\$73.28	
2,001-3,000 work hours		\$41.03	\$58.45	\$75.86	
3,001-4,000 work hours		\$43.62	\$62.34	\$81.04	
=====					

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Classification	Name	Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
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*comment make up day allowed*  
4 10s allowed M-Th or T-F; inclement weather makeup day Friday

LHAZ-Z3-B			12/14/2021	\$45.91	\$65.77	\$85.62	H H H H H H H D Y
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Class B performing work in conjunction with the removal, handling, or containment of hazardous waste substances when the use of personal protective equipment levels "A", "B" or "C" is required.

**Apprentice Rates:**

0-1,000 work hours	\$39.19	\$55.69	\$72.18
1,001-2,000 work hours	\$40.54	\$57.72	\$74.88
2,001-3,000 work hours	\$41.88	\$59.72	\$77.56
3,001-4,000 work hours	\$44.57	\$63.76	\$82.94

*comment make up day allowed*  
4 10s allowed M-Th or T-F; inclement weather makeup day Friday

**Laborer - Landscape**

LLAN-Z1-A			1/4/2022	\$29.25	\$38.73	\$48.20	X X H X X X H D Y
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Class B1: Landscape Operator includes air, gas, and diesel equipment operator, lawn sprinkler installer, skidsteer, mini excavators, backhoe loaders, ride and walk behind trenchers, off road dump vehicle, articulated haulers, hydroseeder, wheel loaders

LLAN-Z1-B			7/28/2023	\$27.25	\$35.73	\$44.20	X X H X X X H D Y
-----------	--	--	-----------	---------	---------	---------	-------------------

Class B2: Skilled Landscape Laborer: small power tool operator, lawn sprinkler installers' tender, irrigation installers' tender, material mover

LLAN-Z2-D			1/7/2022	\$15.54	\$23.31	\$31.08	H H H H H H H D N
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Class D: Inexperienced landscape laborer - individual who has worked less than 90 calendar days

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Classification		Last	Straight	Time and	Double	Overtime
Name	Description	Updated	Hourly	a Half	Time	Provision

=====

**-----**  
**Laborer Underground - Tunnel, Shaft & Caisson**  
**-----**

LAUCT-Z2-1	1/4/2022														
Class I - Tunnel, shaft and caisson laborer, dump man, shanty man, hog house tender, testing man (on gas), and watchman.		\$38.42	\$51.00	\$63.57	X	X	X	X	X	X	X	X	D	Y	

**Apprentice Rates:**

0-1,000 work hours	\$32.85	\$42.64	\$52.43
1,001-2,000 work hours	\$33.97	\$44.32	\$54.67
2,001-3,000 work hours	\$35.08	\$45.99	\$56.89
3,001-4,000 work hours	\$37.31	\$49.33	\$61.35

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LAUCT-Z2-2	1/4/2022													
Class II - Manhole, headwall, catch basin builder, bricklayer tender, mortar man, material mixer, fence erector, and guard rail builder		\$38.51	\$51.13	\$63.75	X	X	X	X	X	X	X	X	D	Y

**Apprentice Rates:**

0-1,000 work hours	\$32.92	\$42.75	\$52.57
1,001-2,000 work hours	\$34.04	\$44.43	\$54.81
2,001-3,000 work hours	\$35.16	\$46.11	\$57.05
3,001-4,000 work hours	\$37.39	\$49.45	\$61.51

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LAUCT-Z2-3	1/4/2022													
Class III - Air tool operator (jack hammer man, bush hammer man and grinding man), first bottom man, second bottom man, cage tender, car pusher, carrier man, concrete man, concrete form man, concrete repair man, cement invert laborer, cement finisher, con		\$38.61	\$51.28	\$63.95	X	X	X	X	X	X	X	X	D	Y

**Apprentice Rates:**

0-1,000 work hours	\$32.99	\$42.85	\$52.71
1,001-2,000 work hours	\$34.12	\$44.55	\$54.97
2,001-3,000 work hours	\$35.24	\$46.23	\$57.21
3,001-4,000 work hours	\$37.49	\$49.60	\$61.71

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Classification Name      Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
=====					
LAUCT-Z2-4	1/4/2022				
Class IV - Tunnel, shaft and caisson mucker, bracer man, liner plate man, long haul dinky driver and well point man.		\$38.77	\$51.52	\$64.27	X X X X X X X D Y
<b>Apprentice Rates:</b>					
0-1,000 work hours		\$33.11	\$43.03	\$52.95	
1,001-2,000 work hours		\$34.25	\$44.74	\$55.23	
2,001-3,000 work hours		\$35.38	\$46.43	\$57.49	
3,001-4,000 work hours		\$37.64	\$49.83	\$62.01	
-----					
LAUCT-Z2-5	1/4/2022				
Class V - Tunnel, shaft and caisson miner, drill runner, keyboard operator, power knife operator, reinforced steel or mesh man (e.g. wire mesh, steel mats, dowel bars)		\$39.03	\$51.91	\$64.79	X X X X X X X D Y
<b>Apprentice Rates:</b>					
0-1,000 work hours		\$33.31	\$43.33	\$53.35	
1,001-2,000 work hours		\$34.45	\$45.04	\$55.63	
2,001-3,000 work hours		\$35.60	\$46.77	\$57.93	
3,001-4,000 work hours		\$37.89	\$50.20	\$62.51	
-----					
LAUCT-Z2-6	1/4/2022				
Class VI - Dynamite man and powder man.		\$39.34	\$52.38	\$65.41	X X X X X X X D Y
<b>Apprentice Rates:</b>					
0-1,000 work hours		\$33.54	\$43.67	\$53.81	
1,001-2,000 work hours		\$34.70	\$45.41	\$56.13	
2,001-3,000 work hours		\$35.86	\$47.15	\$58.45	
3,001-4,000 work hours		\$38.18	\$50.63	\$63.09	
-----					

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Classification	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name Description					
LAUCT-Z2-7	1/4/2022				
Class VII - Restoration laborer, seeding, sodding, planting, cutting, mulching and topsoil grading and the restoration of property such as replacing mail boxes, wood chips, planter boxes and flagstones.		\$31.61	\$40.78	\$49.95	X X X X X X X D Y
<b>Apprentice Rates:</b>					
0-1,000 work hours		\$27.75	\$34.99	\$42.23	
1,001-2,000 work hours		\$28.52	\$36.15	\$43.77	
2,001-3,000 work hours		\$29.29	\$37.30	\$45.31	
3,001-4,000 work hours		\$30.84	\$39.63	\$48.41	
<hr/>					
<b>Laborer -Underground Open Cut, Class I</b>					
LAUC-Z2-1	1/4/2022				
Construction Laborer		\$38.17	\$50.57	\$62.97	X X X X X X X D Y
<b>Apprentice Rates:</b>					
0-1,000 work hours		\$32.74	\$42.42	\$52.11	
1,001-2,000 work hours		\$33.83	\$44.06	\$54.29	
2,001-3,000 work hours		\$34.91	\$45.68	\$56.45	
3,001-4,000 work hours		\$37.09	\$48.95	\$60.81	
<hr/>					
<b>Laborer -Underground Open Cut, Class II</b>					
LAUC-Z2-2	1/4/2022				
Mortar and material mixer, concrete form man, signal man, well point man, manhole, headwall and catch basin builder, guard rail builders, headwall, seawall, breakwall, dock builder and fence erector.		\$38.28	\$50.74	\$63.19	X X X X X X X D Y
<b>Apprentice Rates:</b>					
0-1,000 work hours		\$32.83	\$42.56	\$52.29	
1,001-2,000 work hours		\$33.92	\$44.20	\$54.47	
2,001-3,000 work hours		\$35.01	\$45.83	\$56.65	
3,001-4,000 work hours		\$37.19	\$49.10	\$61.01	
<hr/>					

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<u>Classification</u>	Name Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
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### ----- ~~~~~ **Laborer -Underground Open Cut, Class III** ~~~~~ -----

LAUC-Z2-3		1/4/2022				
	Air, gasoline and electric tool operator, vibrator operator, drillers, pump man, tar kettle operator, bracers, rodder, reinforced steel or mesh man (e.g. wire mesh, steel mats, dowel bars, etc.), cement finisher, welder, pipe jacking and boring man, wagon		\$38.40	\$50.92	\$63.43	X X X X X X D Y
<b>Apprentice Rates:</b>						
	0-1,000 work hours		\$32.92	\$42.70	\$52.47	
	1,001-2,000 work hours		\$34.01	\$44.33	\$54.65	
	2,001-3,000 work hours		\$35.11	\$45.98	\$56.85	
	3,001-4,000 work hours		\$37.30	\$49.26	\$61.23	

### ----- ~~~~~ **Laborer -Underground Open Cut, Class IV** ~~~~~ -----

LAUC-Z2-4		1/4/2022				
	Trench or excavating grade man.		\$38.47	\$51.02	\$63.57	X X X X X X D Y
<b>Apprentice Rates:</b>						
	0-1,000 work hours		\$32.97	\$42.77	\$52.57	
	1,001-2,000 work hours		\$34.07	\$44.42	\$54.77	
	2,001-3,000 work hours		\$35.17	\$46.07	\$56.97	
	3,001-4,000 work hours		\$37.37	\$49.37	\$61.37	

### ----- ~~~~~ **Laborer -Underground Open Cut, Class V** ~~~~~ -----

LAUC-Z2-5		1/4/2022				
	Pipe Layer (including crock, metal pipe, multiplate or other conduits)		\$38.62	\$51.25	\$63.87	X X X X X X D Y
<b>Apprentice Rates:</b>						
	0-1,000 work hours		\$33.08	\$42.94	\$52.79	
	1,001-2,000 work hours		\$34.19	\$44.60	\$55.01	
	2,001-3,000 work hours		\$35.30	\$46.26	\$57.23	
	3,001-4,000 work hours		\$37.51	\$49.58	\$61.65	

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Classification	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name	Description				

**Millwright**

M1102		7/31/2014												
Millwright			\$61.90	\$92.85	\$123.80	H	H	D	H	D	D	D	D	Y
	<b>Apprentice Rates:</b>													
	1st 6 months		\$40.96	\$61.45	\$81.92									
	2nd 6 months		\$43.57	\$65.36	\$87.14									
	3rd 6 months		\$46.19	\$69.28	\$92.38									
	4th 6 months		\$48.81	\$73.22	\$97.62									
	5th 6 months		\$51.42	\$77.13	\$102.84									
	6th 6 months		\$54.03	\$81.05	\$108.06									

*comment make up day allowed Friday*

**Operating Engineer**

EN-324-A120		12/9/2021												
Crane with boom & jib or leads 120' or longer			\$65.71	\$86.00	\$106.28	X	X	H	H	D	D	D	D	Y
	<i>comment</i>													
	Double time after 12 hours M-F													
EN-324-A140		12/10/2021												
Crane with boom & jib or leads 140' or longer	Work in excess of 12 per day M-F shall be paid at double time.		\$66.53	\$87.23	\$107.92	X	X	H	H	D	D	D	D	Y
EN-324-A220		12/10/2021												
Crane with boom & jib or leads 220' or longer	Work in excess of 12 per day M-F shall be paid at double time.		\$66.83	\$87.68	\$108.52	X	X	H	H	D	D	D	D	Y
EN-324-A300		12/10/2021												
Crane with boom & jib or leads 300' or longer	Work in excess of 12 per day M-F shall be paid at double time.		\$68.33	\$89.93	\$111.52	X	X	H	H	D	D	D	D	Y
EN-324-A400		12/10/2021												
Crane with boom & jib or leads 400' or longer	Work in excess of 12 per day M-F shall be paid at double time.		\$69.82	\$92.16	\$114.50	X	X	H	H	D	D	D	D	Y

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Classification Name Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
EN-324-CW Compressor or welding machine Work in excess of 12 per day M-F shall be paid at double time.	12/10/2021	\$54.86	\$69.72	\$84.58	X X H H D D D D Y
EN-324-FL Forklift, lull, extend-a-boom forklift Work in excess of 12 per day M-F shall be paid at double time.	12/10/2021	\$62.17	\$80.69	\$99.20	X X H H D D D D Y
EN-324-FO Fireman or oiler Work in excess of 12 per day M-F shall be paid at double time.	12/9/2021	\$53.83	\$68.18	\$82.52	X X H H D D D D Y
EN-324-RC Regular crane, job mechanic, concrete pump with boom Work in excess of 12 per day M-F shall be paid at double time.	12/10/2021	\$64.85	\$84.71	\$104.56	X X H H D D D D Y
EN-324-RE Regular engineer, hydro-excavator, remote controlled concrete breaker Work in excess of 12 per day M-F shall be paid at double time.	12/10/2021	\$63.88	\$83.25	\$102.62	X X H H D D D D Y
<b>Apprentice Rates:</b>					
0-999 hours		\$46.35	\$58.48	\$70.61	
1,000-1,999 hours		\$48.09	\$61.10	\$74.09	
2,000-2,999 hours		\$49.82	\$63.68	\$77.55	
3,000-3,999 hours		\$51.55	\$66.28	\$81.01	
4,000-4,999 hours		\$53.29	\$68.90	\$84.49	
5,000-5,999 hours		\$55.01	\$71.47	\$87.93	
<b>Operating Engineer - Marine Construction</b>					
GLF D Diver/Wet Tender/Tender/Rov Pilot/Rov Tender	12/16/2021	\$52.81	\$78.57	\$104.32	H H H H H H D N
GLF-1 Diver/Wet Tender, Engineer (hydraulic dredge)	1/7/2022	\$78.97	\$102.47	\$125.97	X X H H H H D Y

Official Request #: 324

Requestor: WTA Architects

Project Description: Center For Forensic Psychiatry Kitchen and Dining Addition

Project Number: 491/20167.SDW

County: Statewide

**Official Rate Schedule**

**Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.**

**Official Commercial Prevailing Wage Rates for State Funded Projects**

**Issue Date: 8/1/2023**

**Contract must be awarded by: 10/30/2023**

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<u>Classification</u>		Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
<i>make up day allowed</i>						
<u>Subdivision of county</u>	all Great Lakes, islands therein, & connecting & tributary waters					
GLF-2		1/7/2022				
Crane/Backhoe Operator, 70 ton or over Tug Operator, Mechanic/Welder, Assistant Engineer (hydraulic dredge), Leverman (hydraulic dredge), Diver Tender			\$77.47	\$100.22	\$122.97	X X H H H H H D Y
<i>make up day allowed</i>						
<u>Subdivision of county</u>	All Great Lakes, islands therein, & connecting & tributary waters					
GLF-2B		1/7/2022				
Friction, Lattice Boom or Crane License Certification30			\$78.97	\$102.47	\$125.97	X X H H H H H D Y
<i>make up day allowed</i>						
<u>Subdivision of county</u>	All Great Lakes, islands, therein, & connecting & tributary waters					
GLF-3		1/7/2022				
Deck Equipment Operator, Machineryman, Maintenance of Crane (over 50 ton capacity) or Backhoe (115,000 lbs or more), Tug/Launch Operator, Loader, Dozer on Barge, Deck Machinery			\$72.92	\$93.40	\$113.87	X X H H H H H D Y
<i>make up day allowed</i>						
<u>Subdivision of county</u>	All Great Lakes, islands therein, & connecting & tributary waters					
GLF-4		1/7/2022				
Deck Equipment Operator, (Machineryman/Fireman), (4 equipment units or more), Off Road Trucks, Deck Hand, Tug Engineer, & Crane Maintenance 50 ton capacity and under or Backhoe 115,000 lbs or less, Assistant Tug Operator			\$66.72	\$84.10	\$101.47	X X H H H H H D Y
<i>make up day allowed</i>						
<u>Subdivision of county</u>	All Great Lakes, islands therein, & connecting & tributary waters					
<b>Operating Engineer Steel Work</b>						
EN-324-ef		12/9/2021				
Forklift, 1 Drum Hoist			\$59.30	\$76.43	\$93.56	H H D H H H D D Y
<i>comment make up day allowed</i>	4 10s allowed M-Th with Friday makeup day because of bad weather					
EN-324-SW120		12/10/2021				
Crane w/ 120' boom or longer			\$68.61	\$90.40	\$112.18	H H D H H H D D Y
<i>comment make up day allowed</i>	4 10s allowed M-Th with Friday makeup day because of bad weather					
EN-324-SW120-O		12/10/2021				
Crane w/ 120' boom or longer w/ Oiler			\$69.61	\$91.90	\$114.18	H H D H H H D D Y

Official Request #: 324

Requestor: WTA Architects

Project Description: Center For Forensic Psychiatry Kitchen and Dining Addition

Project Number: 491/20167.SDW

County: Washtenaw

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**Page 23 of 31**

Classification	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
<i>comment make up day allowed</i>					
4 10s allowed M-Th with Friday makeup day because of bad weather					
EN-324-SW140	12/10/2021	\$69.79	\$92.17	\$114.54	H H D H H H D D Y
Crane w/ 140' boom or longer					
<i>comment make up day allowed</i>					
4 10s allowed M-Th with Friday makeup day because of bad weather					
EN-324-SW140-O	12/10/2021	\$70.79	\$93.67	\$116.54	H H D H H H D D Y
Crane w/ 140' boom or longer W/ Oiler					
<i>comment make up day allowed</i>					
4 10s allowed M-Th with Friday makeup day because of bad weather					
EN-324-SW220	12/10/2021	\$70.06	\$92.57	\$115.08	H H D H H H D D Y
Boom & Jib 220' or longer					
<i>comment make up day allowed</i>					
4 10s allowed M-Th with Friday makeup day because of bad weather					
EN-324-SW220-O	12/10/2021	\$71.06	\$94.07	\$117.08	H H D H H H D D Y
Crane w/ 220' boom or longer w/ Oiler					
<i>comment make up day allowed</i>					
4 10s allowed M-Th with Friday makeup day because of bad weather					
EN-324-SW300	12/10/2021	\$71.56	\$94.82	\$118.08	H H D H H H D D Y
Boom & Jib 300' or longer					
<i>comment make up day allowed</i>					
4 10s allowed M-Th with Friday makeup day because of bad weather					
EN-324-SW300-O	12/10/2021	\$72.56	\$93.20	\$113.84	H H D H H H D D Y
Crane w/ 300' boom or longer w/ Oiler					
<i>comment make up day allowed</i>					
4 10s allowed M-Th with Friday makeup day because of bad weather					
EN-324-SW400	12/10/2021	\$73.06	\$97.07	\$121.08	H H D H H H D D Y
Boom & Jib 400' or longer					
<i>comment make up day allowed</i>					
4 10s allowed M-Th with Friday makeup day because of bad weather					
EN-324-SW400-O	12/10/2021	\$74.06	\$98.57	\$123.08	H H D H H H D D Y
Crane w/ 400' boom or longer w/ Oiler					
<i>comment make up day allowed</i>					
4 10s allowed M-Th with Friday makeup day because of bad weather					

Official Request #: 324

Requestor: WTA Architects

Project Description: Center For Forensic Psychiatry Kitchen and Dining Addition

Project Number: 491/20167.SDW

County: Washtenaw

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**Official Commercial Prevailing Wage Rates for State Funded Projects**

**Issue Date: 8/1/2023**

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Classification Name Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
EN-324-SWCO Crane Operator, Job Mechanic, 3 Drum Hoist & Excavator	12/10/2021	\$68.25	\$89.86	\$111.46	H H D H H H D D Y
<b>Apprentice Rates:</b>					
0-999 hours		\$49.22	\$62.96	\$76.70	
1,000-1,999 hours		\$51.18	\$65.90	\$80.62	
2,000-2,999 hours		\$53.15	\$68.85	\$84.56	
3,000-3,999 hours		\$55.11	\$71.80	\$88.48	
4,000-4,999 hours		\$57.07	\$74.74	\$92.40	
5,000 hours		\$59.04	\$77.69	\$96.34	
<i>comment make up day allowed</i> 4 10s allowed M-Th with Friday makeup day because of bad weather					
EN-324-SWCO-O Crane Operator w/ Oiler	12/10/2021	\$69.25	\$91.36	\$113.46	H H D H H H D D Y
<i>comment make up day allowed</i> 4 10s allowed M-Th with Friday makeup day because of bad weather					
EN-324-SWCW Compressor or Welder Operator	12/10/2021	\$37.03	\$49.48	\$61.92	H H D H H H D D Y
<i>comment make up day allowed</i> 4 10s allowed M-Th with Friday makeup day because of bad weather					
EN-324-SWHO Hoisting Operator, 2 Drum Hoist, & Rubber Tire Backhoe	12/10/2021	\$67.61	\$88.90	\$110.18	H H D H H H D D Y
<i>comment make up day allowed</i> 4 10s allowed M-Th with Friday makeup day because of bad weather					
EN-324-SWO Oiler	12/10/2021	\$53.42	\$67.61	\$81.80	H H D H H H D D Y
<i>comment make up day allowed</i> 4 10s allowed M-Th with Friday makeup day because of bad weather					
EN-324-SWTD50 Tower Crane & Derrick where work is 50' or more	12/10/2021	\$69.34	\$91.49	\$113.64	H H D H H H D D Y
<i>comment make up day allowed</i> 4 10s allowed M-Th with Friday makeup day because of bad weather					
EN-324-SWTD50-O Tower Crane & Derrick 50' or more w/ Oiler	12/10/2021	\$70.34	\$92.99	\$115.64	H H D H H H D D Y
<i>comment make up day allowed</i> 4 10s allowed M-Th with Friday makeup day because of bad weather					

Official Request #: 324

Requestor: WTA Architects

Project Description: Center For Forensic Psychiatry Kitchen and Dining Addition

Project Number: 491/20167.SDW

County: Washtenaw

**Official Rate Schedule**

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**Official Commercial Prevailing Wage Rates for State Funded Projects**

**Issue Date: 8/1/2023**

**Contract must be awarded by: 10/30/2023**

**Page 25 of 31**

Name	Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
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**Operating Engineer Underground**

EN-324A1-UC1		12/10/2021				
Class I Equipment			\$62.64	\$81.46	\$100.27	H H H H H H H D Y
	<b>Apprentice Rates:</b>					
	0-999 hours		\$50.40	\$63.56	\$76.71	
	1,000-1,999 hours		\$52.28	\$66.37	\$80.47	
	2,000-2,999 hours		\$54.15	\$69.18	\$84.21	
	3,000-3,999 hours		\$57.09	\$73.07	\$89.04	
	4,000-4,999 hours		\$57.91	\$74.83	\$91.73	
	5,000-5,999 hours		\$59.80	\$77.66	\$95.51	

EN-324A1-UC2		12/10/2021				
Class II Equipment			\$57.91	\$74.36	\$90.81	H H H H H H H D Y

EN-324A1-UC3		12/10/2021				
Class III Equipment			\$57.18	\$73.27	\$89.35	H H H H H H H D Y

EN-324A1-UC4		12/10/2021				
Class IV Equipment			\$56.61	\$72.41	\$88.21	H H H H H H H D Y

**Painter**

CE514-PT		12/9/2021				
Painter			\$50.12	\$64.80	\$79.73	H H H H H H H D Y
	<b>Apprentice Rates:</b>					
	1st period		\$35.19	\$42.41	\$49.87	
	2nd period		\$38.18	\$46.89	\$55.85	
	3rd period		\$41.16	\$51.36	\$61.81	
	4th period		\$45.64	\$58.08	\$70.77	

Official Request #: 324  
 Requestor: WTA Architects  
 Project Description: Center For Forensic Psychiatry Kitchen and Dining Addition  
 Project Number: 491/20167.SDW  
 County: Washtenaw

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**Official Commercial Prevailing Wage Rates for State Funded Projects**

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Classification Name Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
<b>Pipe and Manhole Rehab</b>					
TM247 General Laborer for rehab work or normal cleaning and cctv work-top man, scaffold man, CCTV assistant, jetter-vac assistant	4/17/2015	\$28.20	\$38.20		H H H H H H H H N
TM247-2 Tap cutter/CCTV Tech/Grout Equipment Operator: unit driver and operator of CCTV; grouting equipment and tap cutting equipment	4/17/2015	\$32.70	\$44.95		H H H H H H H H N
TM247-3 CCTV Technician/Combo Unit Operator: unit driver and operator of cctv unit or combo unit in connection with normal cleaning and televising work	4/17/2015	\$31.45	\$43.07		H H H H H H H H N
TM247-4 Boiler Operator: unit driver and operator of steam/water heater units and all ancillary equipment associated	4/17/2015	\$33.20	\$45.70		H H H H H H H H N
TM247-5 Combo Unit driver & Jetter-Vac Operator	4/17/2015	\$33.20	\$45.70		H H H H H H H H N
TM247-6 Pipe Bursting & Slip-lining Equipment Operator	4/17/2015	\$34.20	\$47.20		H H H H H H H H N

**Official Commercial Prevailing Wage Rates for State Funded Projects**

**Issue Date: 8/1/2023**

**Contract must be awarded by: 10/30/2023**

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Classification	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name	Description				

**Plasterer**

BR2-14-P		11/9/2021												
Plasterer			\$57.16	\$73.88	\$90.60	H	H	H	H	H	H	H	D	N
	<b>Apprentice Rates:</b>													
	0-749 hours		\$45.46	\$56.33	\$67.20									
	750-1,499 hours		\$47.13	\$58.84	\$70.54									
	1,500-2,249 hours		\$48.80	\$61.34	\$73.88									
	2,250-2,999 hours		\$50.47	\$63.84	\$77.22									
	3,000-3,749 hours		\$52.14	\$66.35	\$80.56									
	3,750-4,499 hours		\$53.82	\$68.87	\$83.92									
	4,500 hours		\$57.16	\$73.88	\$90.60									

**Plumber, Pipefitter, Welder & HVAC**

PL-190		12/16/2021												
Plumber, Pipefitter, Welder & HVAC			\$68.20	\$94.78	\$121.36	H	H	H	H	H	H	H	D	Y
	<b>Apprentice Rates:</b>													
	1st Year		\$45.02	\$60.01	\$75.00									
	2nd Year		\$49.05	\$66.06	\$83.06									
	3rd Year		\$53.08	\$72.11	\$91.12									
	4th Year		\$57.12	\$78.17	\$99.20									
	5th Year-1st 6 months		\$59.13	\$81.18	\$103.22									
	5th Year-2nd 6 months		\$61.15	\$84.21	\$107.26									

*comment make up day allowed*  
4 tens can be worked between Monday and Friday

Official Request #: 324  
Requestor: WTA Architects  
Project Description: Center For Forensic Psychiatry Kitchen and Dining Addition  
Project Number: 491/20167.SDW  
County: Washtenaw

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**Official Commercial Prevailing Wage Rates for State Funded Projects**

**Issue Date: 8/1/2023**

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Classification	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name Description					

**Roofer**

RO-70-Z6	1/7/2022				
Commercial Roofer 4 consecutive tens allowed M-TH5 consecutive nine hour days M-F also allowed, time over forty hours per/week shall be at OT. Sat makeup day		\$54.48	\$69.64	\$84.80	H H H X H H H D Y

**Apprentice Rates:**

1st Class	\$34.75	\$43.70	\$52.64
2nd Class	\$38.77	\$48.02	\$57.27
3rd Class	\$40.06	\$49.76	\$59.46
4th Class	\$42.29	\$52.90	\$63.51
5th Class	\$44.50	\$56.02	\$67.54
6th Class	\$45.82	\$57.79	\$69.77
7th Class	\$47.43	\$60.02	\$72.60

*comment make up day allowed Friday or Saturday*

**Sewer Relining**

SR-I	12/10/2021				
Class I-Operator of audio visual CCTV system including remote in-ground cutter and other equipment used in conjunction with CCTV system.		\$49.71	\$67.42	\$85.13	H H H H H H H D N

**Apprentice Rates:**

0-6 months	\$39.05	\$51.43	\$63.81
6-12 months	\$42.83	\$57.10	\$71.37

SR-II	12/10/2021				
Class II-Operator of hot water heaters and circulation system; water jettors; and vacuum and mechanical debris removal systems and those assisting.		\$47.67	\$64.36	\$81.05	H H H H H H H D N

Official Request #: 324

Requestor: WTA Architects

Project Description: Center For Forensic Psychiatry Kitchen and Dining Addition

Project Number: 491/20167.SDW

County: Statewide

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<u>Classification</u>	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name      Description					

**Sheet Metal Worker**

SHM-80	8/1/2023				
Journeyman - A 4 10 schedule may be worked, 4 consecutive days Monday thru Friday.		\$74.96	\$95.01	\$115.06	H H D H D D D D Y

**Apprentice Rates:**

1st & 2nd Periods		\$48.51	\$59.65	\$70.77
3rd & 4th Periods		\$50.74	\$62.99	\$75.23
5th & 6th Periods		\$52.96	\$66.32	\$79.67
7th & 8th Periods		\$55.19	\$69.67	\$84.13

**Sprinkler Fitter**

SP 704	1/7/2022				
Sprinkler Fitter 4 ten hour days allowed Monday-FridayDouble time pay due after 12 hours worked M-F		\$76.92	\$97.18	\$117.43	H H D H D D D D N

**Apprentice Rates:**

1st Period		\$31.91	\$40.00	\$48.09
2nd Period		\$51.25	\$60.36	\$69.47
3rd Period		\$53.58	\$63.71	\$73.83
4th Period		\$55.91	\$67.04	\$78.17
5th Period		\$58.25	\$70.40	\$82.55
6th Period		\$60.58	\$73.73	\$86.89
7th Period		\$62.91	\$77.08	\$91.24
8th Period		\$65.25	\$80.44	\$95.62
9th Period		\$67.58	\$83.78	\$99.98
10th Period		\$69.91	\$87.12	\$104.33

Official Request #: 324

Requestor: WTA Architects

Project Description: Center For Forensic Psychiatry Kitchen and Dining Additon

Project Number: 491/20167.SDW

County: Washtenaw

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**Contract must be awarded by: 10/30/2023**

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<u>Classification</u>	Name	Description	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
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**Tile, Marble and Terrazzo**

BR2-F			12/3/2021				
Tile, Marble and Terrazzo Finisher				\$51.67	\$66.51	\$81.34	H H D H D D D D Y

**Apprentice Rates:**

1st Period				\$34.76	\$44.41	\$54.05
2nd Period				\$36.24	\$46.63	\$57.01
3rd Period				\$37.72	\$48.85	\$59.97
4th Period				\$39.21	\$51.08	\$62.95
5th Period				\$40.69	\$53.30	\$65.91
6th Period				\$42.17	\$55.52	\$68.87

BR2-TMT			12/3/2021				
Tile, Marble Terrazzo Setter				\$58.80	\$77.20	\$95.60	H H D H D D D D Y

**Apprentice Rates:**

1st Period				\$38.77	\$49.81	\$60.85
2nd Period				\$40.61	\$52.57	\$64.53
3rd Period				\$42.45	\$55.33	\$68.21
4th Period				\$44.29	\$58.09	\$71.89
5th Period				\$46.13	\$60.85	\$75.57
6th Period				\$47.97	\$63.61	\$79.25
7th Period				\$49.81	\$66.37	\$82.93
8th Period				\$51.65	\$69.13	\$86.61

Official Request #: 324

Requestor: WTA Architects

Project Description: Center For Forensic Psychiatry Kitchen and Dining Additon

Project Number: 491/20167.SDW

County: Washtenaw

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Classification	Last Updated	Straight Hourly	Time and a Half	Double Time	Overtime Provision
Name	Description				

**Tile, Terrazzo and Mosaic Finisher**

BR2-TF		12/3/2021											
Tile, Terrazzo and Mosaic Finisher			\$42.34	\$54.17	\$65.99	H	H	H	H	H	H	D	N
	<b>Apprentice Rates:</b>												
	1st Period		\$35.25	\$43.53	\$51.81								
	2nd Period		\$36.43	\$45.30	\$54.17								
	3rd Period		\$37.61	\$47.07	\$56.53								
	4th Period		\$38.79	\$48.84	\$58.89								
	5th Period		\$39.97	\$50.61	\$61.25								
	6th Period		\$41.16	\$52.39	\$63.63								

**Truck Driver**

TM-RB2		1/12/2022											
of all trucks of 8 cubic yd capacity or over			\$44.10	\$48.81		H	H	H	H	H	H	H	Y





# GEOTECHNICAL EVALUATION REPORT

MDHHS CENTER FOR FORENSIC PSYCHIATRY  
491/20167.SDW CFP – CREATE KITCHEN

SME Project Number: 088047.00  
February 9, 2022





The Kramer Building  
43980 Plymouth Oaks Blvd.  
Plymouth, MI 48170-2584

T (734) 454-9900

[www.sme-usa.com](http://www.sme-usa.com)

February 9, 2022

Mr. Kurt Fogelsonger AIA, LEED AP  
Senior Project Manager  
WTA Architects  
100 S. Jefferson Ave., Suite 601  
Saginaw, Michigan 48607

Via E-mail: [kfogelsonger@wtaarch.com](mailto:kfogelsonger@wtaarch.com) (PDF file)

RE: Geotechnical Evaluation Report  
MDHHS Center for Forensic Psychiatry  
491/20167.SDW CFP – Create Kitchen  
8303 Platt Road  
York Township, Michigan  
SME Project No. 088047.00

Dear Mr. Fogelsonger:

We have completed our geotechnical evaluation for the MDHHS Center for Forensic Psychiatry 491/20167.SDW CFP – Create Kitchen project in York Township, Michigan. This report presents the results of our observations and analyses, and our geotechnical engineering recommendations based on the information disclosed by the borings.

We appreciate the opportunity to be of service. If you have questions or require additional information, please contact me.

Sincerely,

**SME**

Jeremy S. Wahlstrom, PE  
Project Engineer

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## **APPENDIX A**

**BORING LOCATION DIAGRAM (FIGURE NO. 1)**

**BORING LOG TERMINOLOGY**

**BORING LOGS (B101–B105)**

## **APPENDIX B**

**RELEVANT DATA FROM PREVIOUS GEOTECHNICAL EVALUATION REPORT (SME PROJECT NO. 070637.00) DATED SEPTEMBER 8, 2014 – BORING LOCATION DIAGRAM AND BORING LOGS (B1–B3)**

## **APPENDIX C**

**IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL ENGINEERING REPORT**

**GENERAL COMMENTS**

**LABORATORY TESTING PROCEDURES**

# 1. INTRODUCTION

This report presents the results of the geotechnical evaluation performed by SME for the Michigan Department of Health and Human Services (MDHHS) Center for Forensic Psychiatry (CFP) 491/20167.SDW CFP – Create Kitchen project. We performed this evaluation in general accordance with the scope of services outlined in SME Proposal No. P03319.21, dated October 11, 2021. Our services for this evaluation were authorized by WTA Architects.

To assist with our evaluation and preparation of this report, SME reviewed the following information:

- A drawing titled, “Grading Plan,” (Sheet C2.03), latest issue date of January 27, 2022, prepared by WTA.
- A report titled, “Ground Penetrating Radar (GPR) Subsurface Utility Locating Survey,” (17 pages), dated December 9, 2021, prepared by Testing Engineers & Consultants, Inc.
- A drawing set titled, “Center for Forensic Psychiatry,” (84 sheets), with latest issue date of January 9, 2001, prepared by URS.

We also reviewed our foundation evaluation reports from construction of the CFP in 2001 (SME Project No. 039107.00) as well as our geotechnical evaluation report for a warehouse addition in 2014 (SME Project No. 070637.00).

## 1.1 SITE CONDITIONS

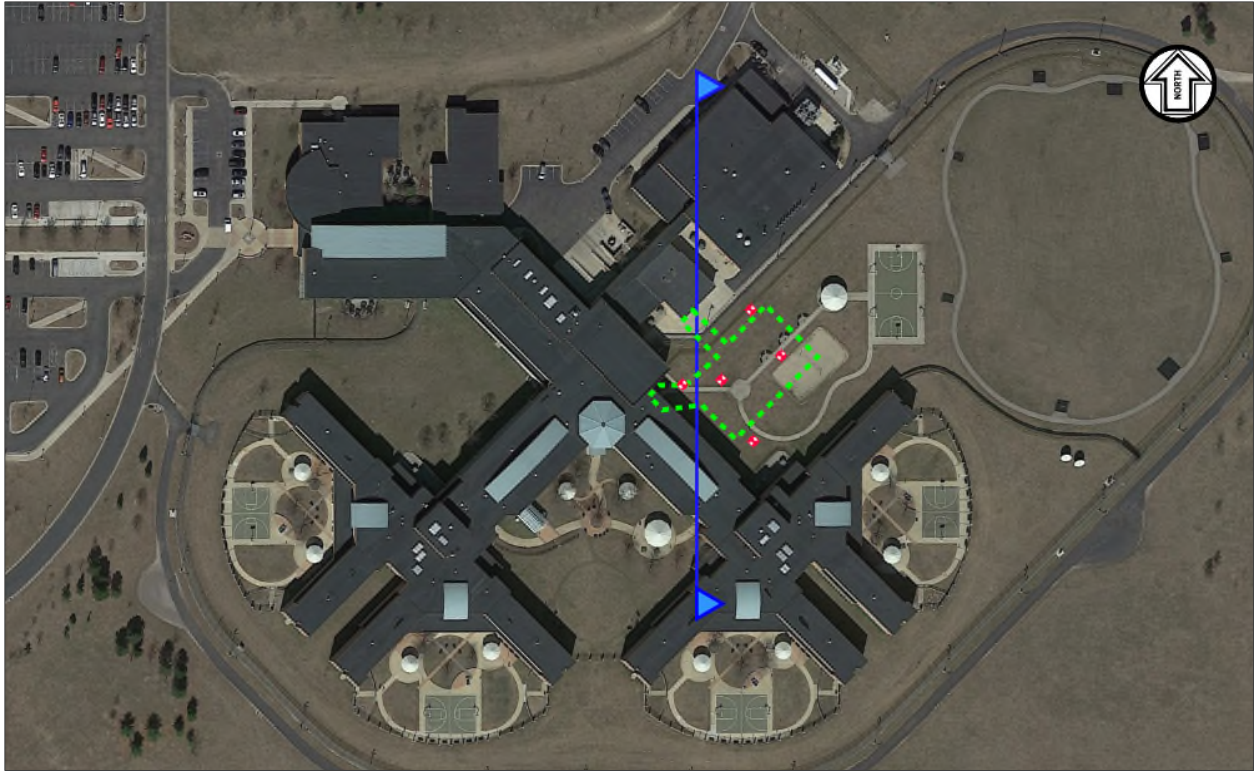
The Center for Forensic Psychiatry is located at 8303 Platt Road in York Township, Michigan. The CFP property extends over an area of about 60 acres and contains a building surrounded by pavements (e.g., parking lots, sidewalks, access drives, etc.) and grass-covered yard areas. The approximate location of the property is depicted on the Boring Location Diagram (Figure No.1), included in Appendix A.

The building is a two-story structure with a footprint area of about 250,000 square-feet. The building contains a central core with wings that extend radially outward. The building core is situated over a full basement and has a finished floor elevation of about 823.5 feet (roughly 12 to 13 feet below exterior grade levels). The building wings are primarily slab-on-grade with finished floor elevations ranging from 836.5 to 837.5 feet depending on the area.

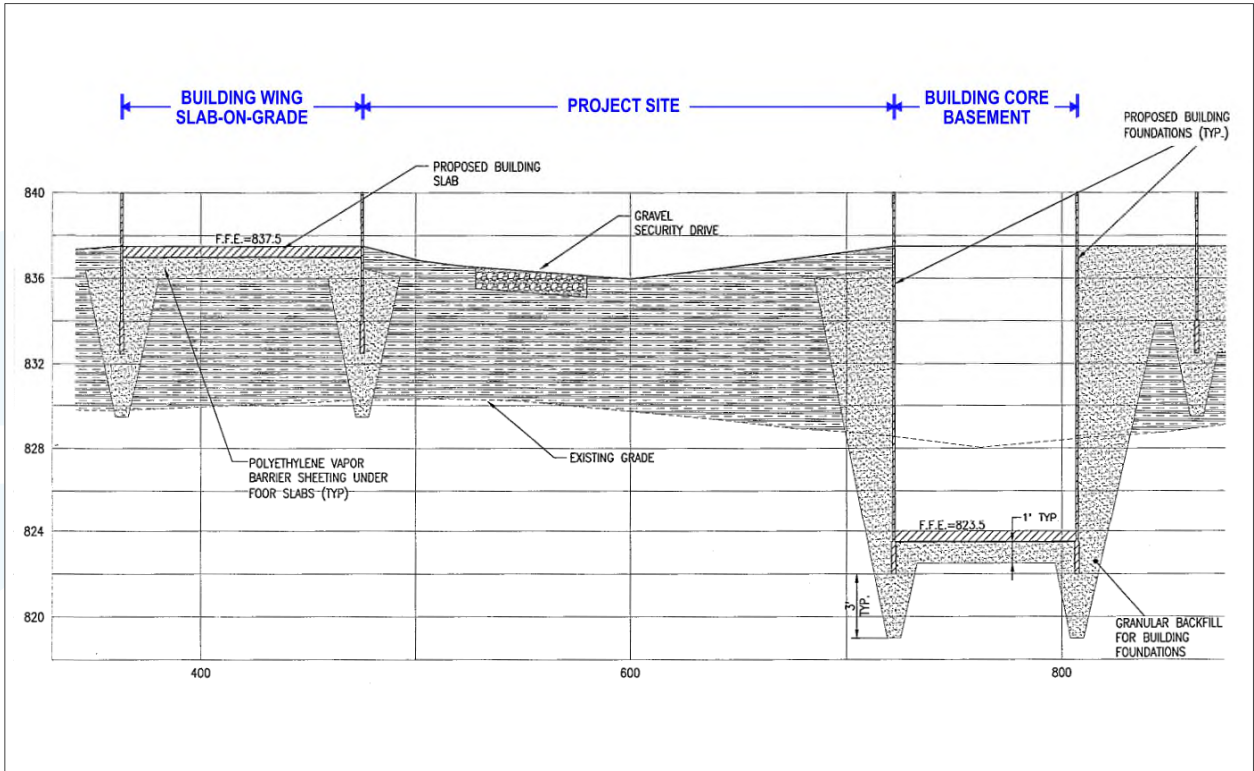
The project site is located northeast of the building core and contains grass-covered lawn areas along with pavements and recreational courts. The site is bisected by sidewalks and fences. In addition, numerous subsurface utilities extend through the site area. An aerial image depicting recent site conditions along with the soil borings performed for this project is provided on the following page.

Based on the provided historic construction drawings along with our previous site experience (refer to Section 1.3 below) we understand the site was raised about 6 to 8 feet above existing grade levels during construction (from approximate previous ground surface elevations 828 to 830 feet to approximate current ground surface elevations 834 to 836 feet). In addition, we understand the building is supported on shallow foundations established on zones of granular engineered fill, with non-structural areas of the site (i.e., areas outside the zone of influence of building foundations) raised with clay fill. The building core foundations have a bearing level of elevation 822 feet and the building wings foundations have a bearing level between elevations 832.5 and 833.5 feet. A cross-section from the historic construction drawings through the project site is also provided on the following page. The approximate location of the historic cross-section is shown on the site aerial, for reference.





SITE AERIAL DATED MARCH 19, 2021



HISTORIC DRAWING, "SITE SECTION," (SHEET NO. C3.1B), DATED JANUARY 9, 2001

SME reviewed publicly available documents as part of our evaluation, including aerial photographs and topographic maps dating back to the 1900's. Based on our review, the site appears to have been utilized as agricultural farmland prior to construction of the CFP. We are not aware of any additional previous site development or usage (e.g., structures, utilities, etc.).

## 1.2 PROJECT DESCRIPTION

The project consists of a new kitchen and dining room building addition. The approximate locations of the planned development features are shown on the Boring Location Diagram.

The building addition will consist of a single-story, slab-on-grade structure with a footprint area of about 13,000 square-feet and a finished floor elevation of 836.5 feet. Based on our experience with similar types of projects, we anticipate structural loads will include maximum column loads of about 100 kips and maximum wall loads of 3 kips per lineal foot. Specific structural loads were not provided to us at this time.

Based on topographic data available on the site grading plan the building addition footprint is relatively flat, with ground surface elevations varying from 835 to 837 feet. We anticipate cuts and fills of up to about 1-foot will be required to established final subgrade levels for the project; however, greater cuts may be required (potentially including mass-excavation) depending on the final determination of the existing utilities.

## 1.3 PREVIOUS SME EVALUATIONS

SME previously provided construction and geotechnical services at the forensic center, including foundation evaluation assistance during original facility construction in 2001 (SME Project No. 039107.00) and a geotechnical evaluation for a warehouse addition in 2014 (SME Project No. 070637.00).

As indicated above, we understand the site was raised about 6 to 8 feet during construction, with the building foundations established on zones of engineered granular fill. As documented in our Foundation Evaluation Reports dated July 31, 2001 and November 30, 2001, the foundation walls were not backfilled for some time following construction of the footings, allowing for stormwater runoff accumulation within the engineered granular fill soils that resulted in soil transport (i.e., piping, sloughing, caving, etc.) and void formation below some of the foundations. SME designed and oversaw a grouting operation in 2001 to remediate the soil loss and support the building foundations and floor slabs.

SME provided additional services at the CFP in 2014 for the design of a warehouse addition in the area located west of the current project site. Relevant geotechnical data from our 2014 evaluation, including boring logs B1 through B3 and the associated boring location diagram, are included in Appendix B of this report for reference. The approximate locations of previous borings are shown on Figure No. 1.

## 2. EVALUATION PROCEDURES

### 2.1 FIELD EXPLORATION

SME completed five borings (designated B101 through B105) at the site on January 21, 2021. The borings were advanced to depth of 15 feet each. A total of 75 lineal feet of drilling was performed for this evaluation. The approximate as-drilled boring locations are shown on Figure No. 1.

SME determined the planned number, depth, and locations of the borings and located the planned borings in the field. SME estimated the existing surface elevations at the as-drilled boring locations to the nearest 1-foot using topographic data available on the provided survey.

The borings were advanced with an ATV track -mounted, rotary drill rig using continuous-flight augers. The borings included soil sampling based upon the Split-Barrel Sampling procedure. Note the Standard Penetration Test (SPT)  $N_{60}$ -values shown on the boring logs represent the modified N-values based on the correlation between the recorded SPT value and the measured hammer efficiency of the testing equipment (also shown on the boring logs). Portions of the recovered split-barrel samples were sealed in glass jars.

Groundwater level observations in the boreholes were recorded during drilling and immediately after completion of drilling. The boreholes were backfilled with auger cuttings after completion and collection of groundwater readings. Therefore, long-term groundwater observations are not available from the borings.

Soil samples recovered from the field exploration were returned to the SME laboratory for further observation and testing.

### 2.2 LABORATORY TESTING

The laboratory testing program consisted of visual soil classification on recovered samples in general accordance with ASTM D-2488. Moisture content and hand penetrometer and/or Torvane shear tests were performed on portions of cohesive samples obtained. The Laboratory Testing Procedures in Appendix B provides descriptions of the laboratory tests performed. Based on the laboratory testing, we assigned a group symbol to the various soil strata encountered based on the Unified Soil Classification System (USCS).

Upon completion of the laboratory testing, we prepared boring logs including the soil descriptions, penetration resistances, pertinent field observations, the results of the laboratory testing, and the existing ground surface elevations. The boring logs are included in Appendix A. Explanations of symbols and terms used on the boring logs are provided on the Boring Log Terminology sheet included in Appendix A.

Soil samples are normally retained in our laboratory for 60 days and are then disposed, unless instructed otherwise.



## 3. SUBSURFACE CONDITIONS

### 3.1 SOIL CONDITIONS

The soil conditions encountered at current borings B101 through B105 generally consisted of surficial topsoil overlying existing fill underlain by natural clay soils extending to the explored depths. Based on previous borings B1 through B3 the natural clays are anticipated to be further underlain by natural sands. We provide a summary of the materials encountered at the boring locations, beginning at the existing ground surface and proceeding downward, below.

#### STRATUM 1 – SURFICIAL MATERIALS

Current borings B101 through B105 were performed in grass-covered lawn areas. The surficial topsoil at the current boring locations ranged from 5 to 10 inches in thickness, as indicated below. Pavements including concrete sidewalks and asphalt parking lots are also present throughout the project site.

- B101 – 10-inches of topsoil
- B102 – 9-inches of topsoil
- B103 – 8-inches of topsoil
- B104 – 8-inches of topsoil
- B105 – 5-inches of topsoil

#### STRATUM 2 – EXISTING FILL

Existing fill was encountered underlying the surficial topsoil at the current borings and extended to depths of about 8 to 9.5 feet below existing site grades. However, based on the historic drawings, we understand existing fill is likely deeper with proximity to the existing basement, potentially extending to depths of about 3 feet below the basement foundation bearing levels, or about 20 feet below existing site grades.

The existing fill encountered at the current borings consisted of sand and clay soils. The sand fill was encountered in a loose condition with SPT  $N_{60}$ -values ranging from 8 to 10 blow-per-foot (bpf) of penetration. The clay fill exhibited medium to hard consistencies, with shear strengths ranging from 0.75 to greater than 4.5 kips-per-square-foot (ksf). Moisture contents of the clay fill ranged from about 11 to 24 percent.

#### STRATUM 3 – NATURAL CLAYS

Natural lean clays were encountered underlying the existing fill and extended to the explored depths at current borings B101 through B105 and to depths of about 17 feet at previous borings B1 through B3. The lean clays exhibited a hard consistency, with shear strengths greater than 4.5 ksf, and had moisture contents ranging from 16 to 22 percent.

#### STRATUM 4 – NATURAL SANDS

Natural sands were encountered underlying the natural clays at previous borings B1 through B3 and extended to the explored depths at these boring locations. Assuming an SPT hammer efficiency of 78% for the previous evaluation (as used for the current borings) the natural sands were encountered in a medium dense to dense condition, with N-values ranging from 21 to 30 bpf and  $N_{60}$ -values ranging from 27 to 39 bpf.

## GENERAL NOTES

Consider thickness measurements of surficial materials reported on the boring logs approximate since mixing of the surficial materials with the underlying subgrade can occur while advancing the augers, and it is difficult to measure the thickness of surface materials in small-diameter boreholes. Therefore, if more accurate surficial material thickness measurements are required, we recommend performing additional evaluations such as hand augers.

It is sometimes difficult to distinguish between fill and natural soils based on samples and cuttings from small-diameter boreholes, especially when portions of the fill do not contain man-made materials, debris, topsoil or organic layers, and when the fill appears similar in composition to the local natural soils. Therefore, consider the delineation of fill described above and on the appended boring logs approximate only. A more comprehensive evaluation of the extent and composition of the existing fill could be made by observing test pit excavations.

The soil profile described above and included on the boring logs are generalized descriptions of the conditions encountered. The stratification depths described above and shown on the logs are intended to indicate a zone of transition from one soil type to another. They are not intended to show exact depths of change from one soil type to another. The soil descriptions are based on visual classification of the soils encountered. Soil conditions may vary between or away from the borings. Please refer to the boring logs for the soil conditions at the specific locations.

## 3.2 GROUNDWATER CONDITIONS

Groundwater was encountered while drilling at depths of 7 to 9 feet below existing grades, corresponding to approximate elevations 827 to 830 feet. Groundwater was observed within the B103 borehole shortly following completion of drilling at a depth of about 12.5 feet below existing grades, corresponding to approximate elevation 822.5 feet. A summary of obtained groundwater measurements is provided in the following table.

### GROUNDWATER MEASUREMENTS

BORING NO.	GROUNDWATER DEPTH (feet)		GROUNDWATER ELEVATION (feet)	
	DURING DRILLING	COMPLETION OF DRILLING	DURING DRILLING	COMPLETION OF DRILLING
B101	Not Encountered	Not Encountered	Not Encountered	Not Encountered
B102	Not Encountered	Not Encountered	Not Encountered	Not Encountered
B103	7.0	12.5	828.0	822.5
B104	9.0	Not Encountered	827.0	Not Encountered
B105	6.0	Not Encountered	830.0	Not Encountered

The encountered groundwater is considered perched within granular seams and layers interbedded within the relatively impermeable existing clay fill soils. In cohesive soils (i.e., clays and clayey silts), a long time may be required for the groundwater level in the borehole to reach an equilibrium position. The use of groundwater observation wells (piezometers) can be necessary to more accurately determine the hydrostatic groundwater level within soil profiles containing clays.

Expect hydrostatic groundwater levels/elevations to fluctuate throughout the year, based on variations in precipitation, evaporation, run-off, and other factors. The groundwater conditions indicated by the borings represent conditions at the time the readings were taken. The groundwater levels at the time of construction may vary from those conditions noted on the boring logs.

## 4. ANALYSIS AND RECOMMENDATIONS

### 4.1 SITE PREPARATION AND EARTHWORK

Site preparation is expected to consist of demolition of the existing site features (e.g., pavements, fences, sidewalks, landscaping, etc.), rerouting of existing utilities, removal of buried slabs/obstructions (if any), compaction of the subgrade using large vibratory rollers, placement of engineered fill, and then the commencement of below-grade construction. Detailed recommendations are provided below.

#### 4.1.1 EXISTING FILL CONSIDERATIONS

Existing fill was encountered to depths of about 8 to 9.5 feet below existing grades at the current boring locations. The existing fill consisted predominately of clay soils with occasional interbedded seams and layers of granular sands. We understand site grades were raised approximate 6 to 8 feet during original construction of the facility, with engineered granular fill utilized under building foundations and along below-grade walls, and clay fill utilized in non-structural areas. The existing fill encountered at the boring locations appears generally consistent with the reported site development with respect to both depth (when accounting for some surficial existing fill predating site construction) and material constituency (i.e., predominately clay soils).

We have not been provided with records indicating the origin of the fill or information about the fill placement or compaction. Based on the variable consistency of the fill samples and the  $N_{60}$ -values obtained from the borings, it appears that some of the existing fill was placed as engineered fill, and some was placed in an uncontrolled manner. For example the existing fill encountered at borings B101, B102, and B103 appears to have been placed as engineered fill, with  $N_{60}$ -values ranged from 8 to 14 bpf, whereas the existing fill at borings B104 and B105 appears to have been marginally controlled as evident by  $N_{60}$ -values of 3 and 5 bpf at the 6.0'-7.5' SPT samples from the respective borings.

Fill that is termed "engineered fill" must be placed under the observation of a geotechnical engineer, with the verification of key elements of the fill placement operations (e.g., preparation of subgrade materials to receive fill, placement of the fill in relatively thin and level lifts at a suitable moisture content, and compaction of the fill with suitable compaction equipment to achieve a minimum of 95 percent of the maximum dry density determined in accordance with the Modified Proctor test). Therefore, we consider the existing fill to be undocumented since we do not have information regarding placement and compaction.

We anticipate most of the existing fill to be of relatively low settlement potential based on the duration of placement (over 20 years), shear strengths (generally greater than 2.0 ksf), and assuming proper subgrade preparation during construction (discussed below). Accordingly, most of the existing fill can be considered for support of foundations, slabs-on-grade, and pavements provided:

- SME is retained to provide construction materials testing
- The subgrade is properly evaluated and prepared as described below
- Zones of unsuitable existing fill (e.g. at borings B104 and B105) are undercut and replaced
- The Owner accepts the associated risk for poor structural performance described below

If SME is not retained to provide construction materials testing and the risks described below are not acceptable to the Owner, remove the existing fill from within the proposed building addition footprint to encounter suitable natural soils, and backfill the subsequent excavations with engineered fill as necessary to establish final subgrade levels.

The increased risk of poor structural performance associated with supporting foundations, slabs-on-grade, and pavements over the existing fill at this site include greater than typical post-construction settlement, resulting in differential movements and associated cracking of the foundations, slabs, and pavements. This risk appears to be relatively low based on the soil boring information. These risks can be reduced, but not eliminated, when SME evaluates the existing fill and foundation, grade slab, and pavement subgrades during construction.

Assuming most of the existing fill will remain in-place for support of foundations and floor slabs, further evaluation of the existing fill during construction must be conducted by SME. Further evaluation includes observing the condition of the existing fill in hand-auger borings or shallow test pits, testing the existing fill several feet below the subgrade surface using a cone penetrometer, observing the condition of the existing fill in the sides of the foundation excavations, and observing the response of the surface of the existing fill when subjected to a proofroll. Suspect existing fill materials observed during the evaluation and testing need be further evaluated by performing additional hand-auger borings and/or test pits and the contractor need to be prepared to assist SME, as needed. Existing fill to remain in-place must be of sufficient strength and free of excess deleterious materials such as debris and organics. Unsuitable existing fill unable to be improved in-place shall be removed (i.e., undercut) and replaced with engineered fill placed and compacted per the requirements outlined in Section 4.1.4 of this report.

#### 4.1.2 SITE SUBGRADE PREPARATION

Following demolition of the existing site features, the underlying subgrade is expected to consist of existing fill soils. Completely remove existing buried structural elements associated with previous construction at the site from within the proposed development areas and backfill with engineered fill. Reroute existing utilities scheduled for relocation outside of the proposed development areas and backfill with engineered fill.

Based on the number of existing subsurface utilities within the building addition footprint, a shallow mass excavation may be required to facilitate utility relocation. To address budgetary concerns, we recommend including a contingency for additional earthwork (e.g., undercutting, in-place compaction, removal of unsuitable fill or overly organic soils, importing suitable fill, etc.) that may be required to improve subsurface conditions. We recommend the utility relocation plan consider other design aspects, such as the elected foundation alternative.

After stripping and removal of unsuitable materials, and making cuts to design subgrade levels, we recommend the exposed subgrade be proofrolled in the presence of SME. Typically, such testing involves a proofroll with a large piece of construction equipment. Where areas are accessible for proofrolling, we recommend using a fully loaded tandem axle truck (50,000 lbs. minimum), or other piece of similar construction equipment to perform the proofroll test. Access may be limited in the relatively small development areas. For such cases we recommend testing the final subgrade for stability using appropriate hand-held tests (e.g. in-place density tests, penetrometer tests, etc.). Improve areas of unsuitable (e.g., loose) subgrade revealed during proofrolling or other tests by compacting in-place, if feasible. Soils unable to be suitably improved in-place must be removed (undercut) and replaced with engineered fill.

The subgrade soils are sensitive to disturbance when exposed to water. If the subgrade is exposed to water, it may be necessary to improve the disturbed subgrade or remove and replace the soils with engineered fill, crushed aggregate or crushed concrete. Placement of crushed aggregate or crushed concrete, possibly with a geotextile for separation, is a traditional treatment to protect subgrades.

After the exposed subgrade is evaluated (as described above) and improved as necessary, engineered fill may be placed on the exposed subgrade to establish final design subgrade levels. Refer to Section 4.1.4 of this report for materials and compaction requirements for engineered fill.

### 4.1.3 SUBGRADE PREPARATION FOR FLOOR SLABS

Support the proposed floor slabs on a subgrade consisting of suitable existing fill or natural soils, or on engineered fill placed over suitable fill or natural soils. Evaluate and prepare the subgrade as described in Sections 4.1.1 and 4.1.2, and place and compact engineered fill as discussed in Section 4.1.4.

Prior to concrete placement for floor slabs, SME needs to observe and test the subgrade in the pad areas of the proposed building to identify areas disturbed during construction activities and verify the final subgrade conditions are suitable for floor slab support. Recompact unsuitable subgrade identified by SME or remove and replace the unsuitable materials with engineered fill. Proofroll final subgrade areas accessible with large equipment in the presence of SME. For areas inaccessible to proofrolling equipment, use hand-operated equipment such as cone penetrometers, hand auger probes, and density gauges.

We recommend the top four inches of the slab subbase consist of an approved MDOT Class II granular material to provide a leveling surface for construction of the slab and a moisture capillary break between the slab and the underlying soils. MDOT 21AA dense-graded aggregate can be used as subbase material, instead of the Class II granular material, for improved stability and greater resistance to disturbance due to construction traffic. The thickness of aggregate needed to provide a stable construction platform will depend on the condition of subgrade soils during construction and the type and volume of construction equipment trafficking the prepared subgrade. The granular material, or dense-graded aggregate if used, must be compacted per Section 4.1.4.

Provide a vapor retarder below floor slabs to receive an impermeable floor finish/seal or a floor covering which would retard vapor transmission. The location of the vapor retarder (relative to the subbase) needs to be determined by the design Architect/Engineer based on the intended floor usage, planned finishes, and ACI recommendations. However, the placement of a vapor retarder affects construction of the floor slab, concrete curing, and the rate of moisture loss as the concrete dries. The flatwork contractor must use the appropriate equipment, materials, and placement/curing methods to prevent undesirable slab curling/warping.

Concrete mixes are regularly changing to optimize performance and economy. We recommend using only concrete contractor(s) with substantial experience in concrete mixing, placement and curing methods (e.g. to prevent undesirable slab curling, shrinkage, segregation, bleeding, etc.). The contractor may need to retain a concrete mix designer to develop the appropriate mix(es) for the project. We recommend using only specific type(s) of well-established concrete mixes 'tried and tested' to deliver successful long-term performance for each specific type of concrete application.

Differential settlements could be manifested where the grade slab of the proposed building addition abuts the existing building. We recommend hard-finish flooring surfaces not span across the interface between the existing building and the proposed building addition without control joints, since minor cracking and/or minor settlement at the interface between the two structures is likely to occur.

Separate floor slabs by isolation joints from structural walls and columns to permit relative movement. Place a minimum of 6 inches of engineered fill between the bottom of the slab and the top of the shallow foundation below.

Protect the slab-on-grade subgrade soils from frost action during winter construction. Frozen soils must be thawed and compacted or removed and replaced prior to slab-on-grade construction.

### 4.1.4 ENGINEERED FILL REQUIREMENTS

Fill placed within structural areas, including utility trench backfill, must be an approved material, free of frozen soil, organics, construction debris, over-sized materials, or other deleterious materials. Compact fill placed in structural areas to a minimum of 95 percent of the maximum dry density determined in accordance with the Modified Proctor test. Spread fill in level layers with a loose thickness appropriate for the type of equipment used to obtain compaction. Thinner lifts will be required in confined spaces and



where compaction is achieved with hand-operated equipment. Sand fill can be compacted with a smooth-drum vibratory roller or vibratory plate compactors, including either walk-behind types or plate compactors mounted on a backhoe or excavator (i.e., hoe-pac). Clay fill can be compacted with sheepsfoot rollers at a moisture content between the optimum and two percent below the optimum.

Based on the information from the borings, the existing fill (barring excess organics or debris) encountered at the boring locations are considered suitable for reuse as site engineered fill provided the material meets the requirements in the previous paragraph and is at a suitable moisture content for compaction. The on-site clays and sands in excess of 5 percent fines (silt or clay) will likely require moisture conditioning (i.e., aeration and drying) to achieve suitable moisture levels for proper compaction.

The site clays (with a USCS designation of "CL") and sands with silt contents in excess of 5 percent (with USCS designations of "SC", "SM", and "SP-SM") will be difficult to compact in confined areas, such as in utility trenches and foundation excavations, where smaller, walk-behind type compaction equipment is used. Clayey and silty soils can be used as engineered fill in open areas where compaction is achieved with large equipment and where moisture conditioning is feasible. During wetter/colder periods of the year when moisture conditioning of the clayey and silty soils will likely not be feasible, we expect it will be necessary to import granular fill to the site and waste the clayey and silty soils on non-structural areas of the site. Do not use clayey and silty soils as engineered fill where drainage is required.

In utility trenches or foundation excavations, and in other areas where compaction is accomplished primarily by smaller plate compaction equipment, we recommend an approved granular material containing relatively low amounts of silt or clay, such as MDOT Class II granular material, be used as backfill. Thinner lift sizes may be required to achieve the required dry density in areas where smaller compaction equipment is used. We also recommend MDOT Class II granular material be used in areas requiring drainage or where the fill will serve as a capillary separation. The soils encountered in the borings, at locations and within depths where cuts are anticipated, are not expected to meet the gradational requirements of MDOT Class II granular material. Therefore, we anticipate soils conforming to MDOT Class II granular material will need to be imported to the site.

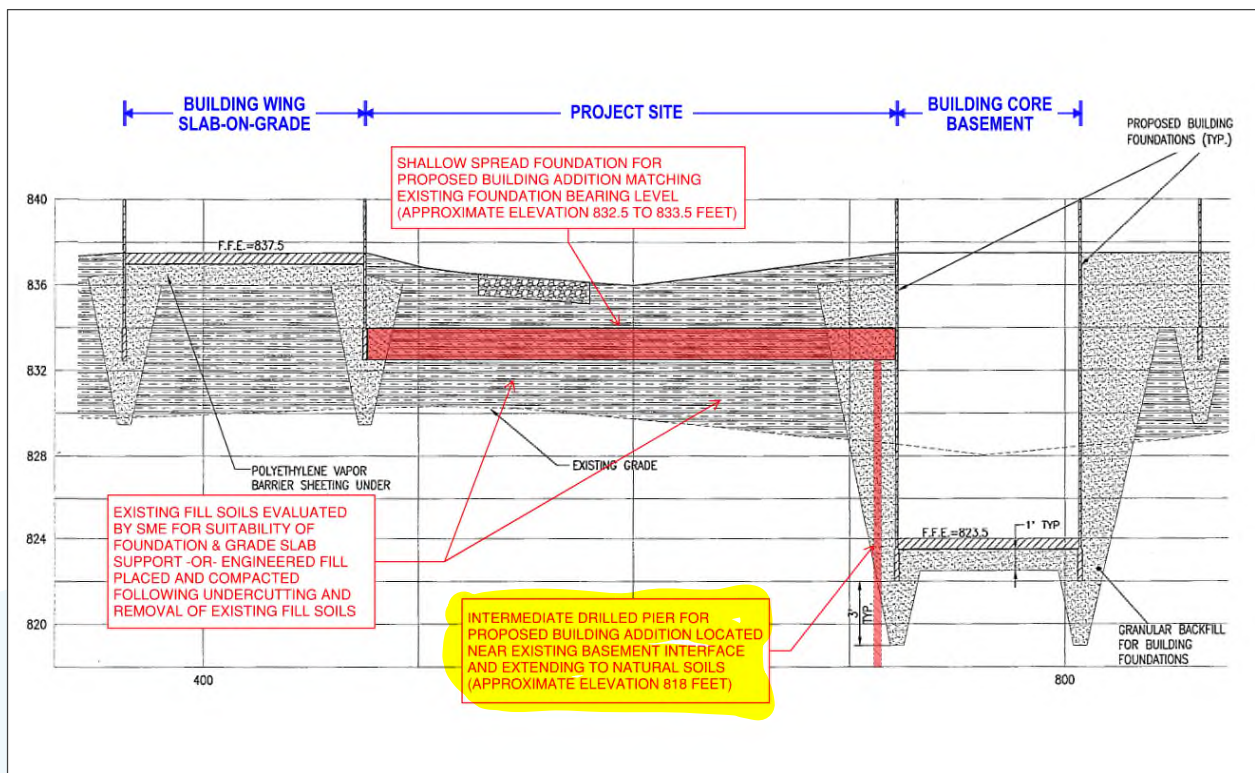
Cap utility trenches excavated into the site clays with at least 18 inches of engineered clay fill at the final subgrade level to provide more uniform support for slabs and pavements. Capping the utility trenches with clay will also mitigate infiltration of water into the sand-filled trenches.

Coarse crushed aggregate used to backfill undercuts or to stabilize subgrades must consist of a well-graded crushed natural aggregate or crushed concrete ranging from 1 to 3 inches in nominal size with no more than 7 percent by weight passing the No. 200 sieve. In cases where granular engineered fill will be placed over the crushed aggregate, top the surface of the coarse crushed material with a layer of at least 6 inches of dense-graded aggregate, such as MDOT 21AA, or covered with a suitable non-woven geotextile, to prevent migration of the granular materials into the coarser crushed aggregate.

## 4.2 FOUNDATIONS

### 4.2.1 FOUNDATION SYSTEMS

We anticipate the planned building addition will be supported on a system of shallow spread foundations with bearing level matching the existing slab-on-grade building foundations (at approximate elevations of 832.5 to 833.5 feet) and utilizing suitable existing fill for foundation support (after verification by SME – refer to Section 4.1) or engineered fill placed and compacted overlying suitable natural soils following undercutting and removal of the existing fill. However, there is a rectangular corridor where the planned building addition abuts the building core where fills 15 to 17-feet deep are anticipated. We anticipate intermediate drilled piers may be desired in-lieu of a mass undercut to match the basement core foundation levels. The drilled piers would transfer the new structural loads below the basement walls and prevent lateral loading (and damage) from new foundations to the existing walls. Refer to image below for a schematic of the respective foundation systems.



### FOUNDATION SYSTEMS

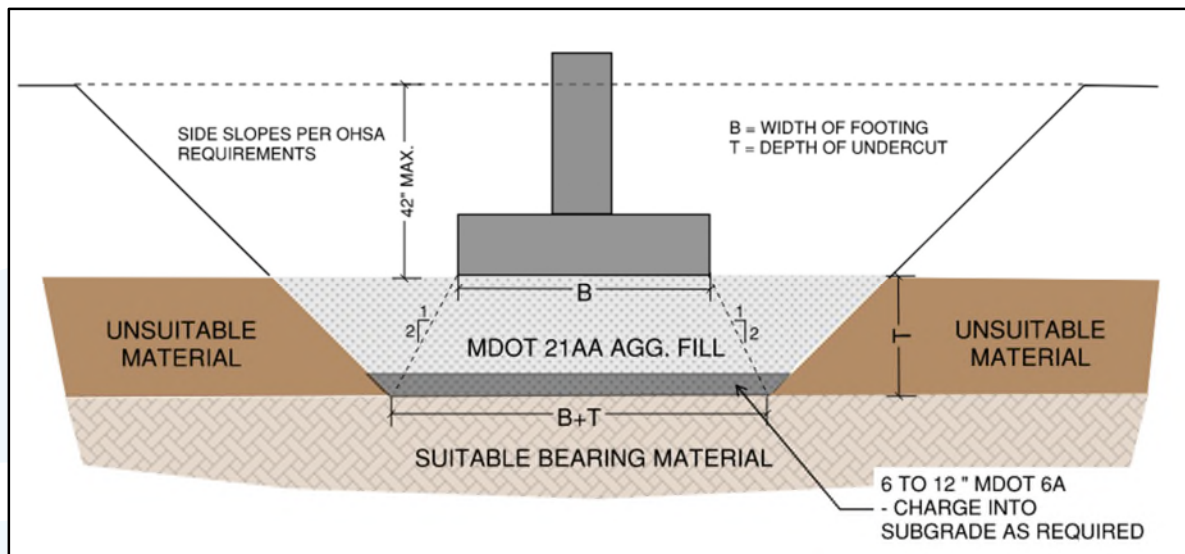
### 4.2.2 SHALLOW SPREAD FOUNDATIONS

The building addition may be supported on shallow spread foundations bearing on suitable existing fill overlying suitable natural soils, or directly on suitable natural soils. Shallow foundations may also bear on engineered fill placed over suitable existing fill or natural soils. Use the following maximum net allowable soil bearing pressures for design of shallow foundations bearing on the respective conditions. The design net allowable soil bearing pressures will achieve a global safety factor of three or more (for general shear failure).

- 2,000 psf for shallow foundations bearing on suitable existing fill overlying suitable natural soils (approximate bearing elevation 831.5 to 832.5 feet)
- 6,000 psf for shallow foundations bearing on suitable natural soils (approximate bearing elevation of 825.5 to 828 feet)
- 4,000 psf for shallow foundations bearing on engineered fill overlying suitable natural soils following undercutting and removal of unsuitable soils (approximate bearing elevation 831.5 to 832.5 feet)

Once each foundation area is exposed, SME must observe and test the foundation subgrades to verify suitable bearing conditions are present. Undercut unsuitable soils (e.g., overly weak clays or loose sands) to expose underlying suitable existing fill or natural soils. In general, suitable existing fill clays are anticipated to be exposed for the foundations. However, improve in-place any overly loose sands where encountered. Undercut and remove soils that cannot be successfully improved in-place (e.g. boring B104 from 6 to 9 feet and B105 from 3 to 8 feet). Groundwater is expected to be trapped/perched within granular seams/layers within the cohesive soil profile and may be encountered during foundation excavation (i.e., conditions similar to borings B103, B104, and B105). The contractor needs to be prepared to use conventional sump pump(s) as required. We expect groundwater seepage will dissipate with time.

Foundations can be constructed at the level where suitable subgrade is encountered, or the design foundation bearing level can be reestablished using engineered fill or crushed aggregate used to backfill the undercut excavation. Where backfilling to the design bearing level is performed, extend the zone of undercutting and backfill laterally on a two vertical to one horizontal slope from the edge of the foundation as shown on the following Typical Foundation Undercutting Diagram.



Situate foundations a minimum of 42 inches below final site grade in unheated areas for protection against frost action during normal winters. Protect the foundations and proposed bearing soils from freezing during construction if work occurs in the winter months.

Vertical excavation sidewalls must be maintained during foundation concrete placement and not be allowed to “mushroom out” at the top. The presence of clay fill and natural clays at this site indicate it may be generally feasible to construct earth-formed or neat-cut foundations. If vertical earthen sidewalls cannot be maintained, it will be necessary to slope back the foundation excavations and form foundation sidewalls to maintain vertical faces for foundations and reduce the potentially adverse effects resulting from frost heave. Remove caved soils from the foundation bearing surfaces before placing concrete. Place foundation concrete as soon as practical after foundation excavations have been completed and the design bearing pressure verified to reduce the potential for disturbance of the foundation subgrade.



For bearing capacity and settlement considerations, design continuous (wall) foundations with a minimum width of 16 inches and isolated (column) foundations with a minimum dimension of 30 inches. In cases where structural loading is light, the minimum recommended foundation size, and not the design bearing pressure, may govern the size of the foundation.

We estimate total settlement for shallow spread or continuous foundations using the recommended maximum net allowable bearing pressure and bearing on suitable soils, as described above, to be 1 inch or less and differential settlements not exceed about one-half the total settlement for similarly loaded foundations. We base the settlement estimates on the available boring information, the estimated structural loads, our experience with similar structures and soil conditions and field verification of suitable bearing soils by SME.

#### 4.2.3 INTERMEDIATE DRILLED PIERS

A system of intermediate drilled piers may be required at the planned building addition interface with the building core. Drilled piers must embed at least 3 feet into natural soils for a target tip depth of 20 feet below existing site grades (approximate elevation 816 feet – or about 6 feet below the existing basement foundation level). Utilize a maximum net allowable soil bearing pressure of 10 ksf for design of drilled pier foundations bearing on natural clays that have at least a very stiff consistency, or natural sands that are at least medium dense in relative density. This allowable bearing pressure is based on a factor of safety of at least 3 applied to the ultimate bearing pressure in compression (assuming a load test will not be performed given the limited anticipated number of piers).

Layers of existing sand fill were encountered in the current borings. We anticipate a greater amount and depth of existing sand fill adjacent to the basement walls based on the historical document discussion on the previous building construction. Open-hole drilling techniques are anticipated to be unfeasible in the sands due to the likelihood for caving and sloughing of the drilled pier sidewalls, as well as the close proximity to the existing building, and full-length temporary steel casing will be required to advance the shafts. Utilize straight-shaft piers (i.e., no bell at the shaft base). For constructability purposes, we recommend a minimum shaft diameter of 2.5 feet.

Rigorous groundwater seepage is not anticipated to be encountered. However, seepage associated with perched groundwater may occur. The use of temporary casing will help mitigate the infiltration of perched groundwater into the shaft excavation. If water bearing soils are encountered during the pier installation which cannot be controlled with casing or wells, wet drilling methods using water or slurry to stabilize the excavation may be necessary. Therefore, the contractor needs to be prepared to change construction methods from “dry” to “wet” drilling methods depending on the conditions encountered.

Construction of all drilled piers must be observed and tested by SME to verify the proper bearing soil has been reached and the bearing surface has been properly cleaned. Due to the anticipated shallow depths of the drilled piers, the cleanliness of the drilled pier excavation can be verified by having the field engineer observe the condition of the bearing surface from the ground surface. The bottom of the drilled pier excavation must be free of loose or disturbed soils prior to placement of the concrete. Cleaning of the bearing surface may be done mechanically with the auger or a “one-eye” bucket and verified by SME prior to concrete placement.

If the piers are constructed in the “dry” (with dry being less than 2 inches of water at the base of the excavation), the concrete may be placed by the free-fall method. The free-fall method consists of using a short hopper or chute to direct the concrete flow out of the concrete truck into a vertical stream of flowing concrete with a relatively small diameter. The stream is directed to avoid hitting the sides of the caissons or any reinforcing cages. For the free-fall method of concrete placement, we recommend the concrete mix be designed with a slump of 5 to 7 inches.

If the piers are constructed under “wet” conditions, a Tremie pipe connected to either a hopper or concrete pump need to be used to displace the water upwards as the concrete is placed. Detailed procedures for this method need to be submitted by the contractor for review and approval by the engineer if this method is used. If at some time during the Tremie placement the groundwater can be sufficiently controlled (e.g., by pumping or temporary casing) concrete placement could be switched over to the free-fall method.

When extracting temporary casings from the excavation, take care to maintain a head of concrete within the temporary casing during removal to prevent infiltration of water and soil into the shaft area. The head of concrete must always be higher than the head of water trapped outside the caisson, taking into account the differences in unit weights of concrete and water.

To reduce lateral movement of the drilled piers, it is necessary to place the pier concrete in intimate contact with the surrounding soil. Any voids or enlargements in the shafts due to over-excavation or temporary casing installation need to be filled with concrete at the time the shaft concrete is placed.

In association with the construction of drilled piers, the time of construction must be considered. We recommend the construction methods assure the drilled shaft excavation is not left open overnight prior to placing of concrete.

We estimate a total static settlement of less than about 1/2-inch at the top of the piles under the recommended design allowable compressive capacity. This settlement estimate is based on the stated soil and loading conditions, and our experience with similar soils.

The above recommendations above are for single piers. The capacity and response of the piers for both vertical and lateral loads will be influenced by adjacent piers depending on the pier spacing and configuration of the piers. For vertical loads, no reduction in the capacity is required for piers spaced at a center to center distance of 3 diameters or greater.

### 4.3 SEISMIC SITE CLASS

Based on the subsurface information obtained from the borings to a maximum depth of 15 feet (for current borings B101 through B105) and 20 feet (for previous borings B1 through B3), and on our previous experience in the project area where deeper borings have been performed, seismic site Class D applies to this site in accordance with the 2015 MBC referencing Table 20.3-1 in ASCE Standard ASCE/SEI 7-16.

### 4.4 CONSTRUCTION CONSIDERATIONS

The contractor must take precautions to protect nearby existing buildings, pavements, and utilities during construction. Exercise care during the excavating and compacting operations, as well as drilled pier operations, so excessive vibrations do not cause settlement of nearby existing buildings, pavements, and utilities, and to avoid undermining existing utilities, floor slabs, or foundations when performing excavations for the proposed construction.

Underpin or shore the existing foundations prior to excavating below the existing foundations. If undercutting for the shallow foundation option is selected, and assuming a current exterior bottom of foundation elevation of 831.5 to 832.5 feet for slab-on-grade portions of the building, excavations may extend several feet below the existing building foundations. In areas where there is insufficient space to temporarily slope back excavations in accordance with applicable regulations, install temporary earth retention systems as-needed, during construction. Underpinning, shoring and earth retention systems must be designed by a qualified professional engineer, and installed by a contractor experienced with construction of these systems. SME is experienced with these services and would be pleased to discuss with you more.

Significant groundwater seepage is not expected to be encountered in site excavations above about 6 feet. However, seepage from precipitation, surface runoff, perched groundwater sources, or other events could be encountered. Control water accumulations in excavations above the groundwater level using standard sump pit and pumping procedures. Utilize a working surface of either crushed aggregate or crushed concrete to protect the exposed subgrade where seepage is encountered.

The existing fill subgrade at this site will be sensitive to disturbance when trafficked, especially when these soils become wet. If the subgrade is disturbed, it will be necessary to disc, aerate, and recompact the disturbed existing sand and clay fill, or to remove and replace the disturbed soils with engineered fill, crushed aggregate, or crushed concrete. To protect areas of prepared subgrade from disturbance and to create dependable haul routes and material laydown areas, placement of crushed aggregate or crushed concrete, possibly with a geotextile for separation, could be required.

Remove ponded surface water and prevent run-off from reaching foundation excavations and areas of prepared subgrade. Establish positive surface drainage at the onset of construction to mitigate the potential for subgrade disturbance.

The contractor must provide safely sloped excavations or adequately constructed and braced shoring systems in accordance with federal, state and local safety regulations for individuals working in an excavation exposing them to the danger of moving ground. If material is stored or heavy equipment is operated near an excavation, use appropriate shoring to resist the extra pressure due to the superimposed loads.

Handling, transportation and disposal of excavated materials and groundwater need to be performed in accordance with applicable environmental regulatory requirements.

## 5. SIGNATURES

We appreciate the opportunity to work with you on this project. There are many benefits in keeping the geotechnical engineer of record involved with the project through engineering support and observation and testing during construction, particularly if any project plans or subsurface conditions differ from those described in this report. Please let us know if you have any questions and if we can assist you further with this project.

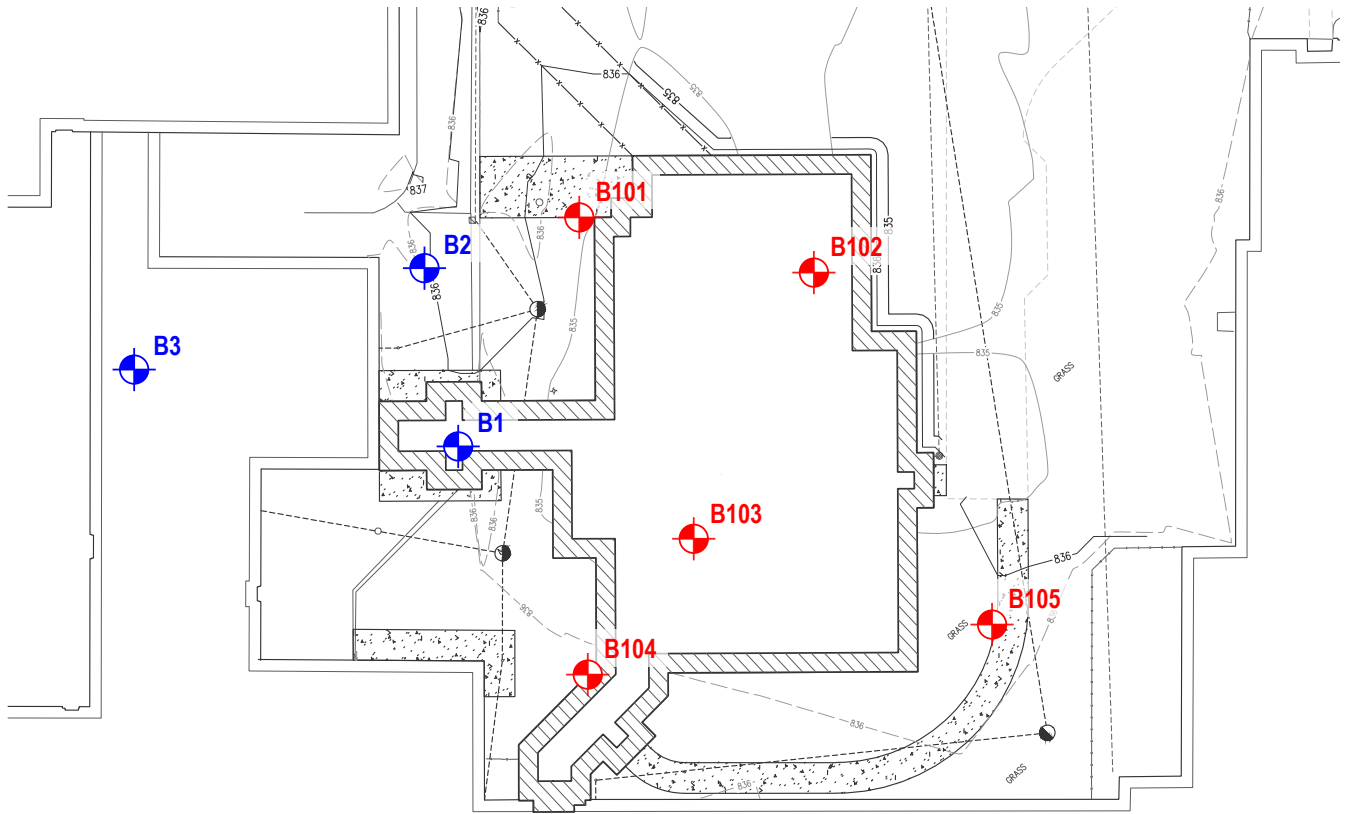
Prepared by:

Jeremy S. Wahlstrom, PE  
Project Engineer



Reviewed by:

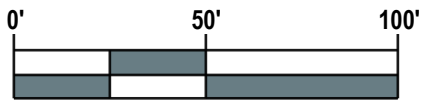
Christopher G. Naida, PE  
Senior Consultant

**APPENDIX A**  
**BORING LOCATION DIAGRAM (FIGURE NO. 1)**  
**BORING LOG TERMINOLOGY**  
**BORING LOGS (B101-B105)**



**LEGEND**

-  APPROXIMATE BORING LOCATION (CURRENT EVALUATION)
-  APPROXIMATE BORING LOCATION (2014 SME EVALUATION)



GRAPHIC SCALE: 1" = 50'

NOTE:  
DRAWING INFORMATION TAKEN FROM A DRAWING TITLED, "GRADING PLAN," (SHEET C2.03), LATEST ISSUE DATE OF JANUARY 27, 2022, PREPARED BY WTA ARCHITECTS AND ROWE PROFESSIONAL SERVICES COMPANY.



**LOCATION MAP**

NOT TO SCALE


















No.	Revision Date	Date	02-02-22
		Drawn By	JSW
		Designed By	JSW
		Scale	1" = 100'
		Project	088047.00













**BORING LOCATION DIAGRAM**  
**MDHHS CENTER FOR FORENSIC PSYCHIATRY**  
**491/20167.SDW CFP - CREATE KITCHEN**  
**8303 PLATT ROAD, YORK TOWNSHIP, MI**



www.sme-usa.com

**Figure No. 1**

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART		
<b>COARSE-GRAINED SOIL</b> (more than 50% of material is larger than No. 200 sieve size.)		
Clean Gravel (Less than 5% fines)		
<b>GRAVEL</b> More than 50% of coarse fraction larger than No. 4 sieve size		GW Well-graded gravel; gravel-sand mixtures, little or no fines
		GP Poorly-graded gravel; gravel-sand mixtures, little or no fines
	Gravel with fines (More than 12% fines)	
		GM Silty gravel; gravel-sand-silt mixtures
		GC Clayey gravel; gravel-sand-clay mixtures
Clean Sand (Less than 5% fines)		
<b>SAND</b> 50% or more of coarse fraction smaller than No. 4 sieve size		SW Well-graded sand; sand-gravel mixtures, little or no fines
		SP Poorly graded sand; sand-gravel mixtures, little or no fines
	Sand with fines (More than 12% fines)	
		SM Silty sand; sand-silt-gravel mixtures
		SC Clayey sand; sand-clay-gravel mixtures
<b>FINE-GRAINED SOIL</b> (50% or more of material is smaller than No. 200 sieve size)		
<b>SILT AND CLAY</b> Liquid limit less than 50%		ML Inorganic silt; sandy silt or gravelly silt with slight plasticity
		CL Inorganic clay of low plasticity; lean clay, sandy clay, gravelly clay
		OL Organic silt and organic clay of low plasticity
<b>SILT AND CLAY</b> Liquid limit 50% or greater		MH Inorganic silt of high plasticity, elastic silt
		CH Inorganic clay of high plasticity, fat clay
		OH Organic silt and organic clay of high plasticity
<b>HIGHLY ORGANIC SOIL</b>		PT Peat and other highly organic soil

OTHER MATERIAL SYMBOLS		
		
		
		
		

LABORATORY CLASSIFICATION CRITERIA	
GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}^2}{D_{10} \times D_{60}}$ between 1 and 3
GP	Not meeting all gradation requirements for GW
GM	Atterberg limits below "A" line or PI less than 4
GC	Atterberg limits above "A" line with PI greater than 7
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{D_{30}^2}{D_{10} \times D_{60}}$ between 1 and 3
SP	Not meeting all gradation requirements for SW
SM	Atterberg limits below "A" line or PI less than 4
SC	Atterberg limits above "A" line with PI greater than 7

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

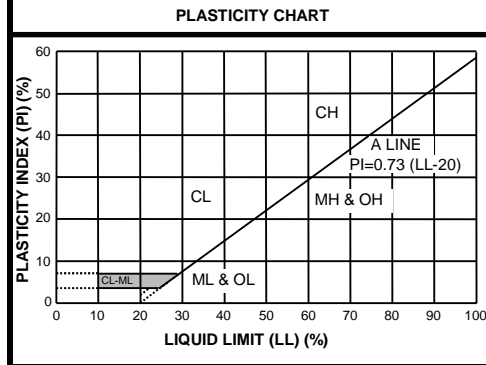
Less than 5 percent.....GW, GP, SW, SP  
 More than 12 percent.....GM, GC, SM, SC  
 5 to 12 percent.....Cases requiring dual symbols

- SP-SM or SW-SM (SAND with Silt or SAND with Silt and Gravel)
- SP-SC or SW-SC (SAND with Clay or SAND with Clay and Gravel)
- GP-GM or GW-GM (GRAVEL with Silt or GRAVEL with Silt and Sand)
- GP-GC or GW-GC (GRAVEL with Clay or GRAVEL with Clay and Sand)

If the fines are CL-ML:

- SC-SM (SILTY CLAYEY SAND or SILTY CLAYEY SAND with Gravel)
- SM-SC (CLAYEY SILTY SAND or CLAYEY SILTY SAND with Gravel)
- GC-GM (SILTY CLAYEY GRAVEL or SILTY CLAYEY GRAVEL with Sand)

PARTICLE SIZES	
Boulders	- Greater than 12 inches
Cobbles	- 3 inches to 12 inches
Gravel- Coarse	- 3/4 inches to 3 inches
Gravel- Fine	- No. 4 to 3/4 inches
Sand- Coarse	- No. 10 to No. 4
Sand- Medium	- No. 40 to No. 10
Sand- Fine	- No. 200 to No. 40
Silt and Clay	- Less than (0.074 mm)



VISUAL MANUAL PROCEDURE
When laboratory tests are not performed to confirm the classification of soils exhibiting borderline classifications, the two possible classifications would be separated with a slash, as follows:
For soils where it is difficult to distinguish if it is a coarse or fine-grained soil:
<ul style="list-style-type: none"> <li>• SC/CL (CLAYEY SAND to Sandy LEAN CLAY)</li> <li>• SM/ML (SILTY SAND to SANDY SILT)</li> <li>• GC/CL (CLAYEY GRAVEL to Gravelly LEAN CLAY)</li> <li>• GM/ML (SILTY GRAVEL to Gravelly SILT)</li> </ul>
For soils where it is difficult to distinguish if it is sand or gravel, poorly or well-graded sand or gravel; silt or clay; or plastic or non-plastic silt or clay:
<ul style="list-style-type: none"> <li>• SP/GP or SW/GW (SAND with Gravel to GRAVEL with Sand)</li> <li>• SC/GC (CLAYEY SAND with Gravel to CLAYEY GRAVEL with Sand)</li> <li>• SM/GM (SILTY SAND with Gravel to SILTY GRAVEL with Sand)</li> <li>• SW/SP (SAND or SAND with Gravel)</li> <li>• GP/GW (GRAVEL or GRAVEL with Sand)</li> <li>• SC/SM (CLAYEY to SILTY SAND)</li> <li>• GM/GC (SILTY to CLAYEY GRAVEL)</li> <li>• CL/ML (SILTY CLAY)</li> <li>• ML/CL (CLAYEY SILT)</li> <li>• CH/MH (FAT CLAY to ELASTIC SILT)</li> <li>• CL/CH (LEAN to FAT CLAY)</li> <li>• MH/ML (ELASTIC SILT to SILT)</li> </ul>

DRILLING AND SAMPLING ABBREVIATIONS	
2ST	- Shelby Tube - 2" O.D.
3ST	- Shelby Tube - 3" O.D.
AS	- Auger Sample
GS	- Grab Sample
LS	- Liner Sample
NR	- No Recovery
PM	- Pressuremeter
RC	- Rock Core diamond bit. NX size, except where noted
SB	- Split Barrel Sample 1-3/8" I.D., 2" O.D., except where noted
VS	- Vane Shear
WS	- Wash Sample

OTHER ABBREVIATIONS	
WOH	- Weight of Hammer
WOR	- Weight of Rods
SP	- Soil Probe
PID	- Photo Ionization Device
FID	- Flame Ionization Device

DEPOSITIONAL FEATURES	
Parting	- as much as 1/16 inch thick
Seam	- 1/16 inch to 1/2 inch thick
Layer	- 1/2 inch to 12 inches thick
Stratum	- greater than 12 inches thick
Pocket	- deposit of limited lateral extent
Lens	- lenticular deposit
Hardpan/Till	- an unstratified, consolidated or cemented mixture of clay, silt, sand and/or gravel, the size/shape of the constituents vary widely
Lacustrine	- soil deposited by lake water
Mottled	- soil irregularly marked with spots of different colors that vary in number and size
Varved	- alternating partings or seams of silt and/or clay
Occasional	- one or less per foot of thickness
Frequent	- more than one per foot of thickness
Interbedded	- strata of soil or beds of rock lying between or alternating with other strata of a different nature

DESCRIPTION OF RELATIVE QUANTITIES	
The visual-manual procedure uses the following terms to describe the relative quantities of notable foreign materials, gravel, sand or fines:	
Trace	- particles are present but estimated to be less than 5%
Few	- 5 to 10%
Little	- 15 to 25%
Some	- 30 to 45%
Mostly	- 50 to 100%

CLASSIFICATION TERMINOLOGY AND CORRELATIONS			
<b>Cohesionless Soils</b>		<b>Cohesive Soils</b>	
<b>Relative Density</b>	<b>N<sub>60</sub> (N-Value) (Blows per foot)</b>	<b>Consistency</b>	<b>N<sub>60</sub> (N-Value) (Blows per foot)</b>
Very Loose	0 to 4	Very Soft	<2
Loose	5 to 10	Soft	2 - 4
Medium Dense	11 to 30	Medium	5 - 8
Dense	31 to 50	Stiff	9 - 15
Very Dense	51 to 80	Very Stiff	16 - 30
Extremely Dense	Over 81	Hard	> 30
		<b>Undrained Shear Strength (kips/ft<sup>2</sup>)</b>	
		< 0.25	0.25 or less
		> 0.25 to 0.50	> 0.25 to 0.50
		> 0.50 to 1.0	> 0.50 to 1.0
		> 1.0 to 2.0	> 1.0 to 2.0
		> 2.0 to 4.0	> 2.0 to 4.0
		> 4.0 or greater	> 4.0 or greater

Standard Penetration 'N-Value' = Blows per foot of a 140-pound hammer falling 30 inches on a 2-inch O.D. split barrel sampler, except where noted. N60 values as reported on boring logs represent raw N-values corrected for hammer efficiency only.



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# BORING B 101

PAGE 1 OF 1

BORING DEPTH: 15 FEET

**PROJECT NAME:** 491/20167.SDW CFP - Create Kitchen

**PROJECT NUMBER:** 088047.00

**CLIENT:** WTA Architects

**PROJECT LOCATION:** York Township, Michigan

**DATE STARTED:** 1/21/22

**COMPLETED:** 1/21/22

**BORING METHOD:** Solid-stem Augers

**DRILLER:** BS (Strata Drilling)

**RIG NO.:** Strata (CME 55) - ATV

**LOGGED BY:** JSW

**CHECKED BY:** CGN

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	ELEVATION: 835± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY: 78% DATE: 12/21/2018 N <sub>60</sub> -- O	DRY DENSITY (pcf) -- ■			MOISTURE & ATTERBERG LIMITS (%) PL MC LL	<ul style="list-style-type: none"> <li>▼ HAND PENE.</li> <li>■ TORVANE SHEAR</li> <li>○ UNC. COMP.</li> <li>□ VANE SHEAR (PK)</li> <li>× VANE SHEAR (REM)</li> <li>◇ TRIAXIAL (UU) SHEAR</li> <li>▲ STRENGTH (KSF)</li> </ul>	REMARKS	
								90	100	110 120				
835	0		0.8 10 inches of TOPSOIL											
	5		FILL- Sandy LEAN CLAY- Occasional Root Fibers- Very Stiff (CL)	SB1	18	4	12							
	5			SB2	18	4	14							
830	6.0		FILL- LEAN CLAY with Sand- Occasional Root Fibers- Brown and Dark Gray- Stiff (CL)	SB3	16	3	10							
	8.0			SB4	16	4	22							
825	10		LEAN CLAY with Sand- Brown and Gray- Hard (CL)			7								
	15		END OF BORING AT 15.0 FEET.	SB5	16	6	34							
	15					11								
	15					15								
815	20													
810	25													
805	30													

<b>GROUNDWATER &amp; BACKFILL INFORMATION</b>	<p>NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.</p> <p>2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.</p>
GROUNDWATER WAS NOT ENCOUNTERED	
<b>BACKFILL METHOD:</b> Auger Cuttings	

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# BORING B 102

PAGE 1 OF 1

BORING DEPTH: 15 FEET

**PROJECT NAME:** 491/20167.SDW CFP - Create Kitchen

**PROJECT NUMBER:** 088047.00

**CLIENT:** WTA Architects

**PROJECT LOCATION:** York Township, Michigan

**DATE STARTED:** 1/21/22

**COMPLETED:** 1/21/22

**BORING METHOD:** Solid-stem Augers

**DRILLER:** BS (Strata Drilling)

**RIG NO.:** Strata (CME 55) - ATV

**LOGGED BY:** JSW

**CHECKED BY:** CGN

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	ELEVATION: 835± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY: 78% DATE: 12/21/2018 N <sub>60</sub> -- O	DRY DENSITY (pcf) -- ■		MOISTURE & ATTERBERG LIMITS (%) PL MC LL	STRENGTH (KSF)				REMARKS
								90	100		110	120	1	2	
835	0		0.8 9 inches of TOPSOIL												
				SB1	18	4	12		20						
			FILL- Sandy LEAN CLAY- Occasional Root Fibers- Brown- Very Stiff (CL)			5									
				SB2	16	3	12		22						
830	5		6.0			4									
			FILL- LEAN CLAY with Sand- Brown and Dark Gray- Hard (CL)			5									
				SB3	16	4	14		18				4.5+		
			8.0			6									
			LEAN CLAY with Sand- Brown and Gray- Hard (CL)			8									
				SB4	16	8	26		20				4.5+		
825	10					12									
						6									
				SB5	16	11	35		16				4.5+		
820	15		15.0			16									
			END OF BORING AT 15.0 FEET.												
815	20														
810	25														
805	30														

<b>GROUNDWATER &amp; BACKFILL INFORMATION</b>
GROUNDWATER WAS NOT ENCOUNTERED
<b>BACKFILL METHOD:</b> Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.  
 2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.



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# BORING B 103

PAGE 1 OF 1

BORING DEPTH: 15 FEET

**PROJECT NAME:** 491/20167.SDW CFP - Create Kitchen

**PROJECT NUMBER:** 088047.00

**CLIENT:** WTA Architects

**PROJECT LOCATION:** York Township, Michigan

**DATE STARTED:** 1/21/22

**COMPLETED:** 1/21/22

**BORING METHOD:** Solid-stem Augers

**DRILLER:** BS (Strata Drilling)

**RIG NO.:** Strata (CME 55) - ATV

**LOGGED BY:** JSW

**CHECKED BY:** CGN

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	ELEVATION: 835± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY: 78% DATE: 12/21/2018 N <sub>60</sub> -- O	DRY DENSITY (pcf) -- ■		MOISTURE & ATTERBERG LIMITS (%) PL MC LL	▼ HAND PENE. ■ TORVANE SHEAR ○ UNC. COMP. □ VANE SHEAR (PK) × VANE SHEAR (REM) ◆ TRIAXIAL (UU) SHEAR STRENGTH (KSF)	REMARKS
								90	100			
835	0		0.7 8 inches of TOPSOIL 834.3									
830	5	[Cross-hatched]	FILL- Sandy LEAN CLAY- Occasional Wet Sand Seams at 7 feet- Brown- Very Stiff to Stiff (CL)	SB1	18	3	8			19	▼	
				SB2	18	2	12			16	▼	
				SB3	2	4	14			21	▼	
825	10	[Diagonal lines]	FILL- Fine to Medium SAND- Brown- Moist- Loose (SP)	SB4	18	7	8			22	▼	4.5+
						3						
820	15	[Horizontal lines]	LEAN CLAY with Sand- Brown- Hard (CL)	SB5	18	8	36			20	▼	4.5+
						12						
END OF BORING AT 15.0 FEET.												
815	20											
810	25											
805	30											

**GROUNDWATER & BACKFILL INFORMATION**

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	7.0	828.0
▽ AT END OF BORING:	12.5	822.5

**BACKFILL METHOD:** Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.  
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.

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# BORING B 104

PAGE 1 OF 1

BORING DEPTH: 15 FEET

**PROJECT NAME:** 491/20167.SDW CFP - Create Kitchen

**PROJECT NUMBER:** 088047.00

**CLIENT:** WTA Architects

**PROJECT LOCATION:** York Township, Michigan

**DATE STARTED:** 1/21/22

**COMPLETED:** 1/21/22

**BORING METHOD:** Solid-stem Augers

**DRILLER:** BS (Strata Drilling)

**RIG NO.:** Strata (CME 55) - ATV

**LOGGED BY:** JSW

**CHECKED BY:** CGN

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	ELEVATION: 836± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY: 78% DATE: 12/21/2018 N <sub>60</sub> -- O	DRY DENSITY (pcf) -- ■				MOISTURE & ATTERBERG LIMITS (%)				REMARKS
								90	100	110	120	PL	MC	LL	SH	
835	0.7		8 inches of TOPSOIL													
835	5		FILL- Sandy LEAN CLAY- Occasional Root Fibers- Brown- Hard to Very Stiff (CL)	SB1	16	4	13									
830	6.0		FILL- LEAN CLAY with Sand- Brown and Gray- Medium to Stiff (CL)	SB2	18	3	12									
830	9.0		FILL- LEAN CLAY with Sand- Brown and Gray- Medium to Stiff (CL)	SB3	18	3	5									
827.0	9.5		FILL- Fine to Medium SILTY SAND- Brown- Wet- Loose (SM)	SB4	18	4	10									
826.5						4										
825			LEAN CLAY with Sand- Brown and Gray- Hard (CL)													
821.0	15.0		END OF BORING AT 15.0 FEET.	SB5	16	6	36									
820						12										
815						16										
810																
30																

GROUNDWATER & BACKFILL INFORMATION		
	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	9.0	827.0
▽ AT END OF BORING:	Note 3	
<b>BACKFILL METHOD:</b> Auger Cuttings		

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.  
 2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.  
 3. Groundwater was not encountered upon completion of drilling.

2/9/22 12:49:56 PM



# BORING B 105

PAGE 1 OF 1

BORING DEPTH: 15 FEET

**PROJECT NAME:** 491/20167.SDW CFP - Create Kitchen

**PROJECT NUMBER:** 088047.00

**CLIENT:** WTA Architects

**PROJECT LOCATION:** York Township, Michigan

**DATE STARTED:** 1/21/22

**COMPLETED:** 1/21/22

**BORING METHOD:** Solid-stem Augers

**DRILLER:** BS (Strata Drilling)

**RIG NO.:** Strata (CME 55) - ATV

**LOGGED BY:** JSW

**CHECKED BY:** CGN

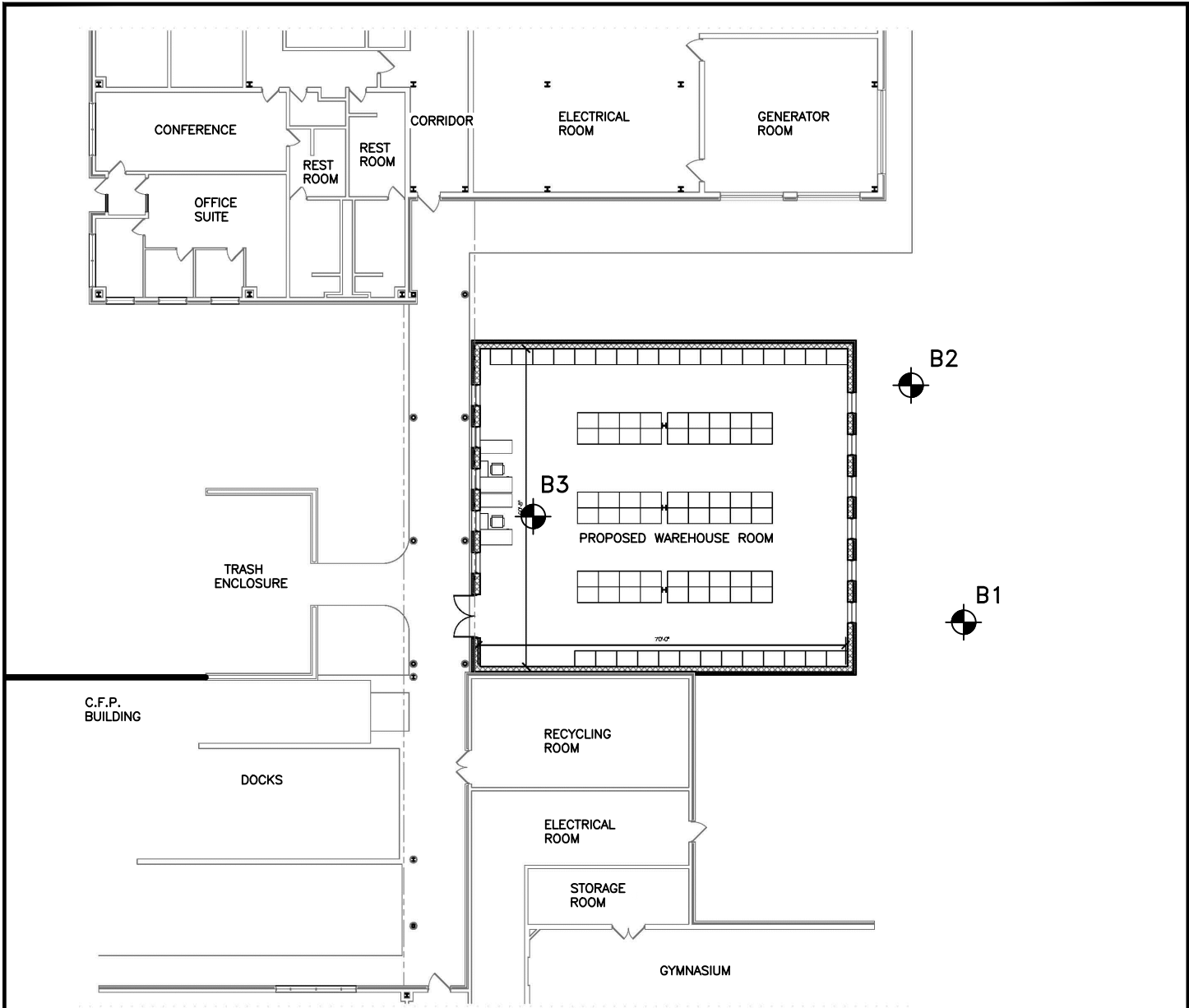
ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	ELEVATION: 836± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY: 78% DATE: 12/21/2018 $N_{60}$ -- O	DRY DENSITY (pcf) -- ■			MOISTURE & ATTERBERG LIMITS (%) PL MC LL	▼ HAND PENE. ■ TORVANE SHEAR ○ UNC. COMP. □ VANE SHEAR (PK) × VANE SHEAR (REM) ◆ TRIAXIAL (UU) SHEAR STRENGTH (KSF)	REMARKS
								90	100	110 120			
	0		0.4 5 inches of TOPSOIL 835.6										
835		[Symbolic Profile: Yellow cross-hatch]	FILL- LEAN CLAY with Sand- Occasional Sand Seams- Brown- Very Stiff (CL) 833.0	SB1	18	4	13		16				
	3.0		FILL- Sandy LEAN CLAY- Brown- Stiff (CL) 831.5	SB2	18	4	8		18				
	4.5		FILL- Fine to Medium SILTY SAND- Brown- Moist- Loose (SM) 830.0			3							
830	6.0		FILL- LEAN CLAY- Occasional Wet Silt Seams- Brown- Medium (CL) 828.0	SB3	18	2	3		24	0.75			
	8.0		LEAN CLAY with Sand- Brown and Gray- Hard (CL)	SB4	18	4	7		16			4.5+	
825						10	22						
	15.0		END OF BORING AT 15.0 FEET. 821.0	SB5	18	5	31		17			4.5+	
820													
	20												
815													
	25												
810													
	30												

GROUNDWATER & BACKFILL INFORMATION		
	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	6.0	830.0
▽ AT END OF BORING:	Note 3	
<b>BACKFILL METHOD:</b> Auger Cuttings		

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.  
 2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.  
 3. Groundwater was not encountered upon completion of drilling.

## **APPENDIX B**

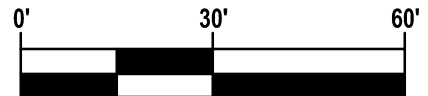
**RELEVANT DATA FROM PREVIOUS GEOTECHNICAL EVALUATION REPORT (SME  
PROJECT NO. 070637.00) DATED SEPTEMBER 8, 2014 - BORING LOCATION  
DIAGRAM AND BORING LOGS (B1-B3)**



**LEGEND**



BORING LOCATION



GRAPHIC SCALE: 1" = 30'

NOTE:  
DRAWING INFORMATION TAKEN FROM SITE PLAN,  
PROVIDED BY CLIENT.

Sep 05, 2014 - 3:51pm - jblake

\\Smefile\work in progress\070637.00\CAD\DWGS\rev0\070637.00-BLD.dwg


 www.sme-usa.com © 2014	Date	9-5-14	<b>BORING LOCATION DIAGRAM</b> <b>CENTER FOR FORENSIC PYSYCHIATRY WAREHOUSE</b> <b>YORK TOWNSHIP, MICHIGAN</b>	No.	Revision Date
	Drawn By	JAB			
	Designed By	KLW			
	Scale	1" = 30'			
	Project	070637.00			

Figure No. 1



**PROJECT NAME:** Center for Forensic Psychiatry Warehouse

**PROJECT NUMBER:** 070637.00

**CLIENT:** Straub Pettitt Yaste

**PROJECT LOCATION:** York Township, Michigan

**DATE STARTED:** 8/28/14

**COMPLETED:** 8/28/14

**BORING METHOD:** Solid-stem Augers

**DRILLER:** JR

**RIG NO.:** 253

**LOGGED BY:** SEB

**CHECKED BY:** MLK

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE -- ○	DRY DENSITY (pcf) -- ■	MOISTURE & ATTERBERG LIMITS (%)	▽ HAND PENE. <input checked="" type="checkbox"/> TORVANE SHEAR ○ UNC. COMP. <input checked="" type="checkbox"/> VANE SHEAR (PK) × VANE SHEAR (REM) ◆ TRIAXIAL (UU) SHEAR STRENGTH (KSF)	REMARKS
							90 100 110 120			
0.0 - 0.3		3 inches of ASPHALT CONCRETE								
0.3 - 1.3		CRUSHED LIMESTONE								
1.3 - 3.0		Fine to Medium SILTY SAND- Brown-Moist- Loose (SM)	SB1	13	8 4 5	9				
3.0 - 5.0		Sandy LEAN CLAY- Frequent Sand Seams- Brown (CL)	SB2	4	4 6 6	12	18			Sample too disturbed for shear strength test
5.0 - 6.0		LEAN CLAY with Sand- Brown- Hard (CL)	SB3	16	6 8 7	15	18		▽	
6.0 - 8.0		LEAN CLAY with Sand- Brown- Hard (CL)	SB4	18	9 8 9	17	22		4.5+ ▽	
8.0 - 15.0		LEAN CLAY- Occasional Silt Partings- Brown & Gray- Hard (CL)	SB5	16	13 12 15	27	16		4.5+ ▽	
15.0 - 17.0		Fine to Medium SAND- Brown- Moist-Medium Dense (SP)	SB6	15	14 14 16	30				
17.0 - 20.0										

END OF BORING AT 20.0 FEET.

**GROUNDWATER & BACKFILL INFORMATION**

GROUNDWATER WAS NOT ENCOUNTERED

**BACKFILL METHOD:** Auger Cuttings capped with Asphalt Cold Patch

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.



**PROJECT NAME:** Center for Forensic Psychiatry Warehouse

**PROJECT NUMBER:** 070637.00

**CLIENT:** Straub Pettitt Yaste

**PROJECT LOCATION:** York Township, Michigan

**DATE STARTED:** 8/28/14

**COMPLETED:** 8/28/14

**BORING METHOD:** Solid-stem Augers

**DRILLER:** JR

**RIG NO.:** 253

**LOGGED BY:** SEB

**CHECKED BY:** MLK

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE -- ○	DRY DENSITY (pcf) -- ■	MOISTURE & ATTERBERG LIMITS (%)	▽ HAND PENE. <input checked="" type="checkbox"/> TORVANE SHEAR ○ UNC. COMP. <input checked="" type="checkbox"/> VANE SHEAR (PK) × VANE SHEAR (REM) ◆ TRIAXIAL (UU) SHEAR STRENGTH (KSF) 1 2 3 4	REMARKS
							90 100 110 120			
0.3		3 inches of ASPHALT CONCRETE								
0.8		CRUSHED LIMESTONE								
1.5		Fine to Medium SILTY SAND- Brown-Moist- Medium Dense (SM)								
3.0		LEAN CLAY with Sand- Occasional Sand Seams- Brown- Very Stiff (CL)	SB1	15	6 7 7	14	16		▽	
5.0		LEAN CLAY with Sand- Occasional Silt Partings- Brown & Gray- Very Stiff to Hard (CL)	SB2	17	4 5 6	11	21		▽	
7.0			SB3	14	7 7 6	13	22		▽	
10.0			SB4	15	6 8 9	17	18		4.5+ ▽	
15.0		Fine to Medium SAND- Brown- Moist-Medium Dense (SP)	SB5	14	7 8 10	18	18		▽	
20.0			SB6	16	7 11 10	21				

END OF BORING AT 20.0 FEET.

**GROUNDWATER & BACKFILL INFORMATION**

GROUNDWATER WAS NOT ENCOUNTERED

**BACKFILL METHOD:** Auger Cuttings capped with Asphalt Cold Patch

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.



**PROJECT NAME:** Center for Forensic Psychiatry Warehouse

**PROJECT NUMBER:** 070637.00

**CLIENT:** Straub Pettitt Yaste

**PROJECT LOCATION:** York Township, Michigan

**DATE STARTED:** 8/28/14

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**BORING METHOD:** Solid-stem Augers

**DRILLER:** JR

**RIG NO.:** 253

**LOGGED BY:** SEB

**CHECKED BY:** MLK

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE -- ○	DRY DENSITY (pcf) -- ■	MOISTURE & ATTERBERG LIMITS (%)	▽ HAND PENE. ☒ TORVANE SHEAR ○ UNC.COMP. ☐ VANE SHEAR (PK) × VANE SHEAR (REM) ◆ TRIAXIAL (UU) SHEAR STRENGTH (KSF) 1 2 3 4	REMARKS
							90 100 110 120			
0		6 inches of Clayey TOPSOIL- Brown								
0.5										
		Sandy LEAN CLAY- Occasional Silt Seams- Brown- Hard (CL)	SB1	14	8 10 10	20	15		4.5+	
3.0										
		LEAN CLAY with Sand- Occasional Sand Seams- Brown & Gray- Stiff to Very Stiff (CL)	SB2	16	3 4 3	7	22			
5										
		LEAN CLAY with Sand- Occasional Silt Partings- Brown & Gray- Hard (CL)	SB3	14	4 4 5	9	22			
8.0										
		LEAN CLAY with Sand- Occasional Silt Partings- Brown & Gray- Hard (CL)	SB4	15	8 9 8	17	19		4.5+	
10										
		LEAN CLAY with Sand- Occasional Silt Partings- Brown & Gray- Hard (CL)	SB5	16	9 9 12	21	18		4.5+	
15										
		Fine to Medium SAND- Brown- Moist-Medium Dense (SP)	SB6	15	10 11 13	24				
17.0										
20.0										

END OF BORING AT 20.0 FEET.

**GROUNDWATER & BACKFILL INFORMATION**

GROUNDWATER WAS NOT ENCOUNTERED

**BACKFILL METHOD:** Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.



## **APPENDIX C**

### **IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL ENGINEERING REPORT**

#### **GENERAL COMMENTS**

#### **LABORATORY TESTING PROCEDURES**

# Important Information about This

# Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

**The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.**

## Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

## Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer

will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

## Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

## You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

### Most of the “Findings” Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site’s subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

### This Report’s Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

### This Report Could Be Misinterpreted

Other design professionals’ misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals’ plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

### Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note*

*conspicuously that you’ve included the material for information purposes only.* To avoid misunderstanding, you may also want to note that “informational purposes” means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

### Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled “limitations,” many of these provisions indicate where geotechnical engineers’ responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

### Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a “phase-one” or “phase-two” environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

### Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer’s services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer’s recommendations will not of itself be sufficient to prevent moisture infiltration.* *Confront the risk of moisture infiltration* by including building-envelope or mold specialists on the design team. *Geotechnical engineers are not building-envelope or mold specialists.*



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## GENERAL COMMENTS

### BASIS OF GEOTECHNICAL REPORT

This report has been prepared in accordance with generally accepted geotechnical engineering practices to assist in the design and/or evaluation of this project. If the project plans, design criteria, and other project information referenced in this report and utilized by SME to prepare our recommendations are changed, the conclusions and recommendations contained in this report are not considered valid unless the changes are reviewed, and the conclusions and recommendations of this report are modified or approved in writing by our office.

The discussions and recommendations submitted in this report are based on the available project information, described in this report, and the geotechnical data obtained from the field exploration at the locations indicated in the report. Variations in the soil and groundwater conditions commonly occur between or away from sampling locations. The nature and extent of the variations may not become evident until the time of construction. If significant variations are observed during construction, SME should be contacted to reevaluate the recommendations of this report. SME should be retained to continue our services through construction to observe and evaluate the actual subsurface conditions relative to the recommendations made in this report.

In the process of obtaining and testing samples and preparing this report, procedures are followed that represent reasonable and accepted practice in the field of soil and foundation engineering. Specifically, field logs are prepared during the field exploration that describe field occurrences, sampling locations, and other information. Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory and differences may exist between the field logs and the report logs. The engineer preparing the report reviews the field logs, laboratory classifications, and test data and then prepares the report logs. Our recommendations are based on the contents of the report logs and the information contained therein.

### REVIEW OF DESIGN DETAILS, PLANS, AND SPECIFICATIONS

SME should be retained to review the design details, project plans, and specifications to verify those documents are consistent with the recommendations contained in this report.

### REVIEW OF REPORT INFORMATION WITH PROJECT TEAM

Implementation of our recommendations may affect the design, construction, and performance of the proposed improvements, along with the potential inherent risks involved with the proposed construction. The client and key members of the design team, including SME, should discuss the issues covered in this report so that the issues are understood and applied in a manner consistent with the owner's budget, tolerance of risk, and expectations for performance and maintenance.

### FIELD VERIFICATION OF GEOTECHNICAL CONDITIONS

SME should be retained to verify the recommendations of this report are properly implemented during construction. This may avoid misinterpretation of our recommendations by other parties and will allow us to review and modify our recommendations if variations in the site subsurface conditions are encountered.

### PROJECT INFORMATION FOR CONTRACTOR

This report and any future addenda or other reports regarding this site should be made available to prospective contractors prior to submitting their proposals for their information only and to supply them with facts relative to the subsurface evaluation and laboratory test results. If the selected contractor encounters subsurface conditions during construction, which differ from those presented in this report, the contractor should promptly describe the nature and extent of the differing conditions in writing and SME should be notified so that we can verify those conditions. The construction contract should include provisions for dealing with differing conditions and contingency funds should be reserved for potential problems during earthwork and foundation construction. We would be pleased to assist you in developing the contract provisions based on our experience.

The contractor should be prepared to handle environmental conditions encountered at this site, which may affect the excavation, removal, or disposal of soil; dewatering of excavations; and health and safety of workers. Any Environmental Assessment reports prepared for this site should be made available for review by bidders and the successful contractor.

### THIRD PARTY RELIANCE/REUSE OF THIS REPORT

This report has been prepared solely for the use of our Client for the project specifically described in this report. This report cannot be relied upon by other parties not involved in the project, unless specifically allowed by SME in writing. SME also is not responsible for the interpretation by other parties of the geotechnical data and the recommendations provided herein.

# LABORATORY TESTING PROCEDURES

## VISUAL ENGINEERING CLASSIFICATION

Visual classification was performed on recovered samples. The appended General Notes and Unified Soil Classification System (USCS) sheets include a brief summary of the general method used visually classify the soil and assign an appropriate USCS group symbol. The estimated group symbol, according to the USCS, is shown in parentheses following the textural description of the various strata on the boring logs appended to this report. The soil descriptions developed from visual classifications are sometimes modified to reflect the results of laboratory testing.

## MOISTURE CONTENT

Moisture content tests were performed by weighing samples from the field at their in-situ moisture condition. These samples were then dried at a constant temperature (approximately 110° C) overnight in an oven. After drying, the samples were weighed to determine the dry weight of the sample and the weight of the water that was expelled during drying. The moisture content of the specimen is expressed as a percent and is the weight of the water compared to the dry weight of the specimen.

## HAND PENETROMETER TESTS

In the hand penetrometer test, the unconfined compressive strength of a cohesive soil sample is estimated by measuring the resistance of the sample to the penetration of a small calibrated, spring-loaded cylinder. The maximum capacity of the penetrometer is 4.5 tons per square-foot (tsf). Theoretically, the undrained shear strength of the cohesive sample is one-half the unconfined compressive strength. The undrained shear strength (based on the hand penetrometer test) presented on the boring logs is reported in units of kips per square-foot (ksf).

## TORVANE SHEAR TESTS

In the Torvane test, the shear strength of a low strength, cohesive soil sample is estimated by measuring the resistance of the sample to a torque applied through vanes inserted into the sample. The undrained shear strength of the samples is measured from the maximum torque required to shear the sample and is reported in units of kips per square-foot (ksf).

## LOSS-ON-IGNITION (ORGANIC CONTENT) TESTS

Loss-on-ignition (LOI) tests are conducted by first weighing the sample and then heating the sample to dry the moisture from the sample (in the same manner as determining the moisture content of the soil). The sample is then re-weighed to determine the dry weight and then heated for 4 hours in a muffle furnace at a high temperature (approximately 440° C). After cooling, the sample is re-weighed to calculate the amount of ash remaining, which in turn is used to determine the amount of organic matter burned from the original dry sample. The organic matter content of the specimen is expressed as a percent compared to the dry weight of the sample.

## ATTERBERG LIMITS TESTS

Atterberg limits tests consist of two components. The plastic limit of a cohesive sample is determined by rolling the sample into a thread and the plastic limit is the moisture content where a 1/8-inch thread begins to crumble. The liquid limit is determined by placing a 1/2-inch thick soil pat into the liquid limits cup and using a grooving tool to divide the soil pat in half. The cup is then tapped on the base of the liquid limits device using a crank handle. The number of drops of the cup to close the gap formed by the grooving tool 1/2 inch is recorded along with the corresponding moisture content of the sample. This procedure is repeated several times at different moisture contents and a graph of moisture content and the corresponding number of blows is plotted. The liquid limit is defined as the moisture content at a nominal 25 drops of the cup. From this test, the plasticity index can be determined by subtracting the plastic limit from the liquid limit.





*Passionate People Building  
and Revitalizing our World*



## SECTION 015000 - AVAILABILITY OF ELECTRONIC FILES

### PART 1 - GENERAL

#### 1.1 POLICY

- A. As a service to bidders, contractors, subcontractors, vendors, material suppliers and others needing electronic copies of drawing files, the Architect will provide electronic files via file transfer through the Project Website in accordance with the following policy.
1. In accepting and utilizing any drawings or data generated and furnished by WTA Architects, the Receiver agrees that all such electronic files are instruments of service of WTA Architects and its consultants, who shall be deemed the author, and shall retain all common law, statutory law and other rights, without limitation, including copyrights.
  2. The Receiver agrees not to reuse these electronic files, in whole or in part, for any purpose other than for the Project. The Receiver agrees not to transfer these electronic files to others without the prior written consent of WTA Architects or its consultants. The Receiver further agrees that WTA Architects and its consultants shall have no responsibility or liability to Receiver or others for any changes made it shall be the Receiver's responsibility to be aware of changes made by WTA Architects, its consultants or the Owner.
  3. It is further understood and agreed that the undersigned Receiver will hold WTA Architects and its consultants harmless, indemnify and defend WTA Architects and its consultants from all claims, liabilities, losses, etc., including attorney's fees arising out of the use or misuse of the transferred items.
  4. It is understood and agreed that the items transmitted are prepared from electronic files current at the time of preparation. **All files are AutoCAD 2018.** The Receiver will specify on request form if an older version is required.
  5. This information does not waive the need to verify and review current field conditions and the status of Addenda and/or Bulletin documentation.
  6. As a record of information to be transmitted, WTA Architects will prepare a duplicate back-up for its files, which may be electronic or hard-copy.
  7. Compensation for providing this material will be as follows: Fees waived.
  8. Signed copy of the Release Letter must be provided before files will be released.

#### 1.2 REQUEST PROCEDURE

- B. To receive files the attached Release Letter must be completed in full and submitted to the Project Manager at WTA Architects.
1. A signed copy of the Release Letter must be submitted; faxed or emailed copies will be accepted.
  2. Upon remittance of the signed Release Letter, allow five working days for processing.

Center For Forensic Psychiatry  
Kitchen  
Michigan Department of Health and Human Services  
Saline, Michigan

File No. 491/20167.SDW  
Index No. 5603  
PSC Project No. 2021094

**Firm Requesting Files:**

Date: \_\_\_\_\_

Name: \_\_\_\_\_  
Company: \_\_\_\_\_  
Address: \_\_\_\_\_  
City, State, Zip: \_\_\_\_\_

Phone: \_\_\_\_\_

**Re: Letter of Authorization for Electronic File Transfers**

Project Name: Center For Forensic Psychiatry - Kitchen

WTA Project No.: 2021094

Dear Sir:

Per your request, WTA Architects will transmit the requested electronic files via file transfer through the project website upon receipt of this letter with conditions of agreement as stated.

1. In accepting and utilizing any drawings or data generated and furnished by WTA Architects, the Receiver agrees that all such electronic files are instruments of service of WTA Architects and its consultants, who shall be deemed the author, and shall retain all common law, statutory law and other rights, without limitation, including copyrights.
2. The Receiver agrees not to reuse these electronic files, in whole or in part, for any purpose other than for the Project. The Receiver agrees not to transfer these electronic files to others without the prior written consent of WTA Architects or its consultants. The Receiver further agrees that WTA Architects and its consultants shall have no responsibility or liability to the Receiver or others for any changes made it shall be the Contractors responsibility to be aware of changes made by WTA Architects, its consultants or the Owner.
3. It is further understood and agreed that the undersigned will hold WTA Architects and its consultants harmless, indemnify and defend WTA Architects and its consultants from all claims, liabilities, losses, etc., including attorney's fees arising out of the use or misuse of the transferred items.
4. It is understood and agreed that the items transmitted are prepared from electronic files current at the time of preparation. **All files are AutoCAD 2018**, unless requested otherwise.
5. This information does not waive the need to verify and review current field conditions and the status of Addenda and/or Bulletin documentation.
6. As a record of information to be transmitted, we will prepare a duplicate back-up for our files, which may be electronic or hard-copy.
7. Compensation for providing this material will be as follows:

Fee: \$ \_\_\_\_\_ Drawings: \_\_\_\_\_

Signed: \_\_\_\_\_ Printed Name/Title: \_\_\_\_\_

*To be Completed by WTA Architects, Inc.*

Released (Signed By): _____	WTA Architects, Inc.
Printed Name/Title: _____	Date: _____

END OF SECTION 005000



SECTION 012500  
MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.01 Work Included

Unless specifically indicated otherwise on the plans or in the contract documents, all materials and equipment shall be new and undamaged.

A. Materials and Equipment

1. Materials and equipment incorporated into the work shall conform to applicable specifications and standards. Materials and equipment shall comply with size, make, type, and quality specified or as specifically approved by the Engineer.
2. Manufactured and fabricated products shall be designed, fabricated, and assembled in accordance with the best engineering and shop practices. Like parts of duplicate units are to be manufactured to standard sizes and gauges to be interchangeable. Two or more items of the same kind shall be identical and manufactured by the same manufacturer. Products shall be suitable for the service conditions. Equipment capacities, sizes, and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing. Materials or equipment shall not be used for any purpose other than that for which it is designed or specified.

1.02 Substitutions

- A. Where specific materials and equipment items are identified in the specifications by manufacturer's name or model number, bids shall be based on the products of one of the manufacturers so named or added thereto by addendum during the bidding period.
- B. During the bidding period, all requests for substitutions will be given full consideration by the Engineer; and if approved, an addendum will be issued to incorporate the approved material or equipment into the contract documents.
- C. Requests for substitutions must be received by the Engineer in ample time, not later than ten days before the bid due date, so that any necessary addendum will be received by all prospective bidders before submission of the bids.
- D. After award of the contract, requests for substitutions will be considered only for one of the following reasons:
  1. Increased value to the Owner
  2. Decreased cost to the Owner
  3. Specified items not procurable
- E. Requests for substitutions after award of the contract shall be accompanied by manufacturer's data or other detailed descriptions of the proposed material or equipment.

- F. A request for a substitution constitutes a representation that the Contractor has investigated and determined the proposed product is equal to or superior in all respects to that specified.
- G. The Contractor shall coordinate the installation of an accepted substitution into the project to provide a complete and operable system. Modifications or re-work of other parts of the project resulting because of substitutes will be at the Contractor's expense.
- H. The Engineer shall be the judge of the acceptability of the proposed substitutions.

#### 1.03 Manufacturer's Instructions

- A. When contract documents require that installation of work shall comply with the manufacturer's printed instructions, the Contractor shall obtain and distribute copies of such instructions to the parties involved in the installation, including two sets to the Engineer. The instructions shall be provided in advance of installation. The Contractor shall notify the Engineer in the event job conditions or the requirements of the plans or specifications conflict with the manufacturer's instructions.
- B. The Contractor shall handle, install, connect, clean, condition, and adjust products in accordance with such instructions and in conformity with the specified requirements.
- C. The Contractor shall perform work in accordance with manufacturer's instructions. No preparatory step or installation procedures shall be omitted unless specifically modified or exempted by contract documents.

### PART 2 - PRODUCTS

Not Applicable

### PART 3 - EXECUTION

#### 3.01 Transportation and Handling

- A. The Contractor shall arrange deliveries of products in accordance with construction schedules and coordinate them to avoid conflict with work and conditions at the site.
  - 1. Products shall be delivered in undamaged condition, in the manufacturer's original containers or packaging with identifying labels intact and legible.
  - 2. Immediately upon delivery, the Contractor shall inspect shipments to assure compliance with requirements of contract documents and approved submittals and that products are properly protected and undamaged.
- B. The Contractor shall provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

#### 3.02 Storage and Protection

- A. Products shall be stored in accordance with the manufacturer's instructions, with seals and labels intact and legible.

1. Products subject to damage by the elements shall be stored in weather tight enclosures.
  2. Temperature and humidity shall be maintained within the ranges required by manufacturer's instructions.
- B. The Contractor shall arrange storage in a manner to provide easy access for inspection and make periodic inspections to assure that products are maintained under specified conditions and free from damage or deterioration.
- C. For products specified by naming one or more products or manufacturers and "or equal", the Contractor must submit a request for substitutions for any product or manufacturer not specifically named.

END OF SECTION 012500

SECTION 013214  
SCHEDULE REQUIREMENTS

PART 1 - GENERAL

1.01 Work Included

The Contractor shall develop a detailed schedule, identifying various phases or divisions of work, indicating a start date and duration required for each. The schedule shall be presented to the Engineer or Owner in sufficient detail, as may be required by the Engineer or Owner, for their approval.

Periodically through the life of the project and as required by the Engineer or Owner, the Contractor shall update the schedule and provide copies to the Engineer and Owner.

1.02 Requirements

The Contractor shall schedule work to be performed during normal business hours, unless otherwise directed on the plans or approved by the Engineer.

Once work has begun on the project, the Contractor shall work continuously and expeditiously to complete all work provided for by the contract.

Project shall be substantially completed in accordance with the date specified in the agreement. Substantial completion is the stage of completion where the project is fit for occupancy and use without hindrance for its intended purpose.

Project shall be fully completed and ready for final payment in accordance with the date specified in the agreement.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

Not Applicable

END OF SECTION 013214

SECTION 013300  
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 Work Included

- A. This section includes procedures for preparing and transmitting submittals required by specification sections for a product, material, or construction method. Submittals shall include the following:
  - 1. Shop drawings
  - 2. Product data
  - 3. Manufacturer's certificates
  - 4. Design data and calculations
  - 5. Manufacturer's instructions
  - 6. Manufacturer's field service reports
  - 7. Samples
  - 8. Operation and maintenance manuals (timing, quantity, content, and form)
- B. It is the responsibility of the General Contractor to convey the requirements of this section to their sub-contractors and their suppliers and vendors.

1.02 Submittals

- A. Schedule submittals to expedite work. Unless otherwise indicated in this section, submittals shall be submitted within 30 days of date of Notice to Proceed.
- B. Preparation
  - 1. Provide separate submittals for each specification section requiring submittals. Where multiple sections relate to the same system or element and are being provided from the same source, a single combined submittal is acceptable.
  - 2. Coordinate submission of related items. Group submittals of related products in a single transmission.
  - 3. Include all submittal material requested for that section.
  - 4. Identify variations from requirements of contract documents. State product and system limitations which may adversely affect work.
  - 5. Mark or show dimensions and values in same units as specified.
- C. Contractor Responsibilities
  - 1. Review submittals prior to transmittal. Verify compatibility with field conditions and

dimensions, product selections and designations, quantities, and conformance of submittal with requirements of contract documents. Return non-conforming submittals to preparer for revision, rather than submitting for review.

2. Coordinate submittals to avoid conflicts between various items of work.
3. Submittal Transmittal Form
  - a. Include with each submittal a transmittal form. A sample copy of an acceptable form is included in Attachment A. The Contractor's standard submittal form may be used, provided it contains essentially the same information as the sample.
  - b. Identify project, Contractor, subcontractor, supplier, manufacturer, pertinent drawing sheet and detail numbers, and associated specification section numbers.
  - c. Sequentially number transmittal forms. Re-submittals shall have original number with a suffix. Acceptable form of number is SS SS SS-NN-T where:
    - i. SS SS SS indicates specification section number;
    - ii. NN indicates different submittals for that specification section; and
    - iii. T indicates the number of times that submittal has been made.
4. Failure of the Contractor to review submittals, prior to transmittal for review, shall be cause for rejection.
5. Incomplete, improperly packaged, and submittals from sources other than the Contractor will not be accepted.

#### D. Transmittal

Where possible, transmit all submittals electronically. Where electronic submittal is not possible, submit four paper copies for the Engineer's retention, plus as many copies as the Contractor desires returned after review. Samples shall be submitted as described elsewhere in this specification.

#### E. Review

The Engineer will review and return submittals with comments.

- F. Do not fabricate products or begin work which requires submittals until return of reviewed submittal with A/E or SNL SE acceptance.
- G. On return, promptly distribute reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

#### H. Resubmission

1. Revise and resubmit submittals, as required, within 15 days of return from initial review.
2. Make re-submittals under procedures specified for initial submittals.
3. Identify all changes made since previous submittal.

### 1.03 Quality Assurance and Quality Control

#### A. Where required by specification sections, provide quality assurance submittals:

##### 1. Qualification Data

Contractor shall submit written information demonstrating capabilities and experience of firm or person. Include lists of complete projects with names and contact information for references.

##### 2. Manufacturer's Certificates

Submit reference data, affidavits, and certifications on manufacturer's letterhead certifying that products conform to or exceed specified requirements. Certificates may be based on recent or previous test results supplied by manufacturer and accepted by the Engineer.

##### 3. Installer Approval

Certification on manufacturer's letterhead that installer complies with requirements and is approved for installing manufacturer's products.

##### 4. Welding Certificates

Written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specifications (WPS) and Procedure Qualification Record (PQR) on American Welding Society (AWS) forms. Include names of firms and personnel certified.

##### 5. Field Test Reports

Written reports from qualified testing agency indicating and interpreting results of field tests performed either during or after installation for compliance with specified requirements.

### 1.04 Submittal Review

A. The Engineer will review submittals for the sole purpose of verifying general conformance with design intent and general compliance with contract documents. Approval of submittal by the Engineer does not relieve the Contractor of responsibility for correcting errors which may exist in submittal, or from meeting requirements of contract documents.

#### B. Review Time

Initial review will be performed within 14 days of receipt. Reviewer reserves the right to withhold action on a submittal requiring review of related submittals, until related submittal is received. Additional time will be required if processing must be delayed to permit review of related subsequent submittals. The Engineer will review re-submittals within 14 days.

#### C. Review Actions

After review, submittals will be returned and marked as follows to indicate action taken:

##### 1. Reviewed, No Comments

Part of work covered by submittal may proceed, provided it complies with requirements

of contract documents. Final acceptance will depend upon that compliance.

2. Reviewed, With Comments

Part of work covered by submittal may proceed, provided it complies with notations and corrections on submittal and requirements of contract documents. Final acceptance will depend upon that compliance.

3. Revise and Resubmit

Do not proceed with part of work covered by submittal including purchasing, fabricating, and delivering. Revise or prepare new submittal in accordance with notations and resubmit.

1.05 Drawings

- A. Where required by specifications or otherwise needed, prepare drawings illustrating portion of work for use in fabricating, interfacing with other work, and installing products. Contract drawings shall not be reproduced and submitted as shop drawings.
- B. When construction is complete, prepare and submit red-lined copies of the contract drawings showing clearly how construction deviated from the design, along with the authority for the deviation or change.
- C. Electronic Format
  - 1. Size printable to: 8½ inches by 11 inches minimum and 24 inches by 36 inches maximum.
  - 2. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawing with reference number.
  - 3. Plans, elevations, sections, and detail shop drawings shall be to scale, with scale indicated.
  - 4. Indicate field verified dimensions. Show relationship of products to adjacent work. Note coordination requirements.
  - 5. Schematics and diagrams shall be logically arranged and presented in a clear, understandable manner with all items labeled.
  - 6. Internal wiring diagrams: Provide internal wiring and elementary ladder diagrams for factory pre-wired equipment.
  - 7. Control diagrams: Show relative positions of each component as a system diagram.

1.06 Product Data

- A. Provide product data such as manufacturer's brochures, catalog pages, illustrations, diagrams, tables, performance charts, and other material which describe appearance, size, attributes, code and standard compliance, ratings, and other product characteristics.
- B. Form
  - 1. Provide all critical information such as reference standards, performance characteristics,



capacities, power requirements, wiring and piping diagrams, controls, component parts, finishes, dimensions, and required clearances.

2. Submit only data which are pertinent. Mark each copy of manufacturer's standard printed data to identify products, models, options, and other data pertinent to project.
3. Modify manufacturer's standard schematic drawings and diagrams and supplement standard data to provide specific information applicable to project. Delete information not applicable.
4. Colors and Patterns: Unless color and pattern is specified for product, submit accurate color and pattern charts or samples illustrating manufacturer's full range for selection by the Engineer. Submit two hard copies only.

#### 1.07 Design Data and Calculations

- A. Where required by specification sections, provide basic calculations, analyses, and data to support design decisions and demonstrate compliance with specified requirements. State assumptions and define parameters. Give general formulas and references. Provide sketches, as required, to illustrate design method and application.
- B. Arrange calculations and data in a logical manner, with suitable text to explain procedures and order.
- C. Indicate name, title, and telephone number of individual performing design and include professional seal of designer where applicable or required.

#### 1.08 Manufacturer's Instructions

- A. Where required by specification sections, provide manufacturer's instructions for activities such as delivery, storage, assembly, installation, wiring, start-up, adjusting, and finishing.
- B. Indicate pertinent portions and identify conflicts between manufacturer's instructions and contract documents.
- C. Where appropriate, include preparation procedures; service connection requirements; critical ambient conditions; foundation requirements; special precautions; adjustment requirements; alignment procedures; leveling; purging; charging; lubrication; and cleaning prior to operation and/or Owner's acceptance.
- D. Installation (e.g., assembly, mounting, or wiring) and start-up instructions shall be submitted and available for review in the field prior to scheduled material or equipment installation.

#### 1.09 Samples

- A. Submit samples to illustrate functional and aesthetic characteristics of products with all integral parts and attachment devices. Include full range of manufacturer's standard finishes, indicating colors, textures, and patterns for Engineer selection.
- B. Submission  
Submit the number of samples specified in individual specification sections. One sample will

be retained by the Engineer.

C. Label with identification related to submittal transmittal form.

1.10 Manufacturer's Field Service Reports

A. When an individual specification section requires services of manufacturer's field representative, submit report of observations, site decisions, and instructions given to installers.

B. Form

1. Present complete information in clear concise manner.
2. Bind with titled cover in folder or binder.

C. Report shall include:

1. Time, location, conditions, and duration of activity;
2. Names of persons performing and witnessing activity;
3. Equipment used;
4. Description of activity, data recorded, and results;
5. Deficiencies found, corrective measures, and results of retesting; and
6. Other pertinent data.

D. Submit report within 30 days of construction site service visit.

1.11 Operation and Maintenance Data

A. Where required by specification sections, provide operation and maintenance manuals.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

Not Applicable

END OF SECTION 013300

ATTACHMENT A - SAMPLE SUBMITTAL TRANSMITTAL FORM

Attachment A

SAMPLE SUBMITTAL TRANSMITTAL FORM

PROJECT: \_\_\_\_\_

CONTRACT NUMBER: \_\_\_\_\_

SUBMITTAL NUMBER: \_\_\_\_\_ RESUBMITTAL: YES NO

DATE: \_\_\_\_\_ NUMBER OF COPIES SUBMITTED: \_\_\_\_\_

SUBMITTAL DESCRIPTION: \_\_\_\_\_

RELATED DESIGN DISCIPLINE (circle):

Civil	Landscape	Architectural	Structural
Mechanical	Electrical	Telecommunications	Security
Fire Protection	Controls	Other: _____	

ASSOCIATED SPECIFICATION SECTION NO: \_\_\_\_\_

REFERENCED DRAWING SHEET NO: \_\_\_\_\_

SUBCONTRACTOR/SUPPLIER/MANUFACTURER PROVIDING SUBMITTAL DATA:

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

CONTRACTOR:

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

CONTRACTOR'S CERTIFICATION:

The undersigned, as representative of the Contractor for the above project, submits the following and certifies that:

1. Submittal has been reviewed and it is complete and conforms to requirements of contract documents, except as noted.
2. Required dimensions have been field verified and are acceptable for installation of proposed products and construction of proposed work.
3. Required quantities for products and materials covered by this submittal have been verified as correct.
4. Fabrication processes and construction methods proposed in this submittal are acceptable for this project and will result in a complete, functional installation.
5. Submittal has been coordinated with other submittals and work and proposed products and construction will properly interface with other construction.

NAME OF CONTRACTOR REVIEWER: \_\_\_\_\_

SIGNATURE OF CONTRACTOR REVIEWER: \_\_\_\_\_

DATE: \_\_\_\_\_

SECTION 014516.01  
CONCRETE TESTING

PART 1 - GENERAL

1.01 Work Included

This work includes requirements for concrete, concrete submittals, and testing.

1.02 References

Where materials or methods of construction are listed as being in conformance with a standard specification, it shall refer to the latest edition of the standard specification or any interim revision.

- A. ACI PRC-211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
- B. ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field
- C. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
- D. ASTM C138 – Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
- E. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete
- F. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete
- G. ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
- H. ASTM C595 – Standard Specification for Blended Hydraulic Cements
- I. ASTM C1064 – Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
- J. ASTM C1260 – Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
- K. ASTM C1293 – Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction
- L. ASTM C1567 – Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
- M. ASTM E29 – Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
- N. Michigan Department of Transportation 2020 Standard Specifications for Construction

- O. Michigan Test Methods (MTM)
- P. Michigan Department of Transportation Qualified Products List

1.03 Related Work

- A. Section 321300 – Concrete Curb and Gutter, Sidewalk, and Miscellaneous Pavement

1.04 Submittals

- A. Prior to beginning construction, the Contractor shall submit the name and plant location of the proposed NRMCA certified concrete supplier for the project.
- B. Prior to beginning construction, the Contractor shall submit mix designs for the proposed concrete mixtures proposed for use on the project for the Engineer to review.

1.05 Quality Assurance and Quality Control

- A. The Owner will be responsible for Quality Control and Quality Assurance Testing.
- B. Concrete Testing
  - 1. The temperature of concrete will be determined in accordance with ASTM C1064.
  - 2. Samples of concrete for testing will be obtained in accordance with ASTM C172.
  - 3. The slump of concrete will be determined in accordance with ASTM C143.
  - 4. The air content of concrete will be measured in accordance with ASTM C231.
  - 5. Concrete cylinders for compressive testing will be made in accordance with ASTM C31. The Engineer and Contractor shall use the same size cylinder for test specimens. Four-inch cylinders are preferred, as allowed by ASTM C31.
  - 6. The compressive strength of concrete will be determined in accordance with ASTM C39.

PART 2 - PRODUCTS

2.01 Mix Design and Documentation

Design concrete mixtures shall meet the requirements specified in Table 1. The Contractor shall provide the grade of concrete for the section number reference application specified in Table 1, or as specified in the contract. The Contractor shall submit a request variance, in writing, when proposing a mix design that exhibits temperature, slump, or air content other than those specified. This submittal shall include the proposed mix design, Job Mix Formula (JMF), and associated trial batch verification test data. Do not use a grade of concrete with a lower specification limit (LSL) 28-day compressive strength less than what is designated for the application.

Blended cement meeting the requirements of ASTM C595 Type IL is permitted.

Secure prior approval from the Engineer to use concrete intended for early opening to traffic to facilitate driveway gaps or other features necessary for required local access.

Unless otherwise specified in the contract, set accelerating admixtures are prohibited.

Unless otherwise specified in the contract, do not exceed 40 percent replacement of the Portland cement in the concrete mixture with slag cement (Grade 100 minimum) or fly ash. Do not exceed 40 percent total replacement of the Portland cement if both slag cement and fly ash are used in the concrete mixture.

Use the combined weight of all cementitious materials to determine compliance with the maximum water-cementitious ratio and cementitious material content requirements specified in Table 1.

<b>Table 1: Minimum Mix Design Requirements for Concrete</b>					
		<b>Concrete Grade</b>			
		<b>3,000</b>	<b>3,500</b>	<b>4,000</b>	<b>4,500</b>
Compressive strength (psi)	7-day	2,200	2,600	3,000	3,200
	28-day	3,000	3,500	4,000	4,500
	70%	2,100	2,450	2,800	3,150
Flexural Strength (psi)	7-day	500	550	600	625
	28-day	600	650	700	750
	70%	420	455	490	525
Slump (inch)		(c)-(f)	(c)-(k)	(l)-(n)	(d)-(f)
Cementitious material content (lb/cyd)		489-517	517-611 (o)	517-611	517-658
Class of coarse aggregate		(p)-(r)			
Maximum w/cm ratio		0.45			
Air content range		5.5-8.5%			

- a. Reserved for future use.
- b. Reserved for future use.
- c. 0- to 3-inch slump for mixtures for pavements.
- d. 0- to 3-inch slump without admixtures or with Type A or D admixture.
- e. 0- to 6-inch slump after the addition of Type MR admixture.
- f. 0- to 7-inch slump after the addition of Type F or G admixture.
- g. 3- to 7-inch slump for tremie applications without admixture or with Type A or D admixture.
- h. 3- to 7-inch slump for tremie applications after the addition of Type MR admixture.
- i. 3- to 8-inch slump for tremie applications after the addition of Type F or G admixture.
- j. 6- to 8-inch slump for dry placed drilled shafts.
- k. 7- to 9-inch slump for wet placed drilled shafts.
- l. 3- to 5-inch slump without admixtures or with Type A or D admixture.
- m. 3- to 6-inch slump after the addition of Type MR admixture.
- n. 3- to 7-inch slump after the addition of Type F or G admixture.

- o. For concrete pavement repair mixtures, use 658 lb/cyd of cement when the weather is forecast to be above 50 degrees Fahrenheit or 752 lb/cyd when the weather is forecast to be 50 degrees Fahrenheit or below.
- p. Use aggregates only from geologically natural sources for pavement, shoulder, miscellaneous pavement (including ramps), concrete pavement overlay, bridge approach slab, structural concrete, drilled shaft, bridge railing, and bridge sidewalk applications.
- q. Unless otherwise required, use Coarse Aggregate 6AA or 17A for exposed structural concrete in bridges, retaining walls, and pump stations.
- r. The flexural and compressive strengths are not part of the specifications but are listed for informational purposes only and are the minimum strengths anticipated for the mix proportions specified for the various grades of concrete when cured under standard conditions.

#### B. Alkali-Silica Reactivity

Provide documentation to the Engineer that the concrete mixture does not present the potential for excessive expansion caused by alkali-silica reactivity (ASR). Provide current ASR test results (valid for two years from completion of testing), for the fine aggregate that is proposed to be used in the concrete from an independent testing laboratory proficient in ASR testing. The independent testing laboratory must certify, in writing, that all testing was conducted in accordance with the designated standard test procedures described herein. Test results must conform to the specified criterion for one of the following standard test methods. Use the Rounding Method described in ASTM E29 when determining significant digits for reporting expansion test results.

##### 1. Method 1 – ASTM C1260 Mortar Bar Test

If the expansion of the mortar bars is less than 0.10 percent (rounded to the nearest 0.01 percent) at 14 days of immersion, the fine aggregate is considered non-deleterious to ASR and may be used in the concrete without the need for ASR mitigation.

##### 2. Method 2 – ASTM C1293 Concrete Prism Test

- a. If the expansion of concrete prisms is not greater than 0.040 percent (rounded to the nearest 0.001 percent) after 1 year, the fine aggregate is considered non-deleterious to ASR and may be used in the concrete without the need for ASR mitigation.
- b. If the expansion of concrete prisms is greater than 0.040 percent, but not exceeding 0.120 percent (rounded to the nearest 0.001 percent) after 1 year, the fine aggregate is considered moderately deleterious to ASR and mitigation is required, as follows. A low-alkali cement with Na<sub>2</sub>O equivalent alkalis (Na<sub>2</sub>O + 0.658 × percent K<sub>2</sub>O) not exceeding 0.60 percent must be used in the concrete mixture to mitigate the potential for ASR. Slag cement or fly ash may be used in conjunction with the low-alkali cement. The total alkali content for the cementitious materials combination must not exceed 3 pounds per cubic yard of Na<sub>2</sub>O equivalent.

##### 3. Method 3 – ASTM C1567 Accelerated Mortar Bar Test

If no previous test data are available for the fine aggregate that shows it is resistant to

ASR using either Method 1 or 2 above, replace 25 percent to 40 percent of the Portland cement in the concrete mixture with slag cement (Grade 100 minimum) or fly ash. A blended cement meeting the requirements of ASTM C595 containing Portland cement and slag cement or fly ash may also be used.

Demonstrate the ability of the fly ash or slag cement to control the deleterious expansion caused by ASR by molding and testing mortar bars according to the standard test method described in ASTM C1567, using the mix proportions and constituent sources for both the aggregates and the cementitious materials that will be used for the project. Make at least three test specimens for each cementitious materials-aggregate combination. If the average of 3 mortar bars for a given cementitious materials-aggregate combination produces an expansion less than 0.10 percent (rounded to the nearest 0.01 percent) at 14 days of immersion, the JMF associated with that combination will be considered non-deleterious to ASR. If the average expansion is 0.10 percent (rounded to the nearest 0.01 percent) or greater, the JMF associated with that combination will be considered not sufficient to control the deleterious expansion caused by ASR and the JMF will be rejected.

The Engineer will not approve the use of the JMF if the expansion exceeds the respective threshold limits for the respective ASTM test method used.

#### C. Mix Documentation

Provide mix design and accompanying JMFs using the methods of verification included in this specification. Include sufficient information on constituent materials and admixtures, along with trial batch verified physical properties of the fresh concrete, mix proportions per cubic yard for all constituents, and compressive strength test results necessary to allow the Engineer to fully evaluate the expected performance of the concrete mixture.

Submit mix design and JMF; include accompanying documentation. List the source of materials, bulk density (unit weight) of coarse aggregate (rodding procedure or shoveling procedure), absorption of aggregates, relative density (specific gravity) of aggregates, aggregate correction factors, batch weights, and project specific or historical laboratory test data. Include the recorded air content of fresh concrete using the same admixture and cementitious material sources to be used in the production of the concrete for the project. A JMF will be approved only if all of the minimum mix design requirements specified in the contract have been met. Use of the MDOT Job Mix Formula Concrete Field Communication Form (MDOT Form Number 1976) is encouraged.

##### 1. Job Mix Formula

Select proportions for concrete mixtures according to ACI Standard 211.1. The volume (oven-dry-rodded) of coarse aggregate per unit volume of concrete must be 65 percent, minimum.

Four methods of verification of proposed JMF are acceptable.

##### a. Method 1 – Trial Batches

Verification of JMF is based on trial batches with the same materials and proportions



proposed for use on the project. Prepare at least one trial batch for each mix design in sufficient time before starting concrete placement to allow for review, according to subsection 2.01.B of this specification. Provide the results of temperature, slump, density (unit weight), air content of fresh concrete, 28-day compressive strength, and age of concrete at the time of strength testing, for a minimum of 3 independent samples. All samples may be taken from a single trial batch for a mix design, provided the trial batch is at least 4 cubic yards in volume. For JMF trial batch verification purposes only, 7-day compressive strength test results which report at least 70 percent of the specified 28-day lower specification limit will be sufficient documentation, in lieu of 28-day compressive strengths. The average of at least two strength test specimens represents one compressive strength sample test result for each independent sample. Provide the necessary ASR documentation as described in subsection 2.01.B of this specification.

b. Method 2 – Same Mix

Verification of JMF is based on experience with the same mix design, JMF, and the same materials. Provide the results of temperature, slump, density (unit weight), air content of fresh concrete, 28-day compressive strength, and age of concrete at the time of strength testing, for a minimum of 3 independent samples produced within the previous 12 months. The average of at least two strength test specimens represents one compressive strength sample test result for each independent sample. Do not substitute material types or sources, including admixtures or cementitious materials, nor change mix proportions in the JMF. Provide the necessary ASR documentation as described in subsection 2.01.B of this specification.

c. Method 3 – Similar Mix

Verification of JMF is based on requirements described in Method 2 above. Substitution of coarse aggregate source is permitted if the new source is of the same geologic type as the original aggregate, and conforms to the specification requirements for the application. Substitution of fine aggregate is permitted only if the new source has been tested for ASR. Provide the necessary ASR documentation as described in subsection 2.01.B of this specification.

Provide the supporting laboratory trial batch documentation and accompanying calculations showing how the mix proportions in the JMF were adjusted, based on the documented differences in relative density (specific gravity), bulk density (unit weight), and absorption of the substituted aggregate sources, to produce a theoretical yield of 100 percent and the required fresh concrete properties.

d. Method 4 – Annual Verification

At the Engineer's option, verification may be accepted annually for a concrete plant rather than on a project basis provided the sources and proportions of the constituent materials, including cementitious materials and source and types admixtures, do not change. If the project is the continuation of work in progress during the previous construction season and written certification is submitted to the Engineer that materials from the same source and with the same mixture properties are to be used, the Engineer may waive the requirement for annual renewal verification of the JMF

for the project. Provide the necessary ASR documentation as described in subsection 2.01.B of this specification.

### PART 3 - EXECUTION

#### 3.01 Sampling and Testing

A. The following ASTM test methods will apply.

1. C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field
2. C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
3. C138 – Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
4. C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete
5. C172 – Standard Practice for Sampling Freshly Mixed Concrete
6. C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

B. Sampling

Sampling and testing shall be conducted by the Engineer at a rate determined by the Engineer/Owner during placement of the concrete. The Engineer shall take a random sample at a rate of approximately once per 50 cubic yards, based on the anticipated total quantity of concrete to be placed and site conditions, with a minimum of 1 sampling for each day of production per mix design. The sampling rate may be increased by the Engineer if project conditions warrant increased testing. A minimum of 3 cylinders shall be taken for each test (one 7-day break and two 28-day breaks).

Samples will be taken from the concrete at the location as close to its final placement into the forms or on the grade as practical. If sampling from the discharge of the haul unit, the sample will be taken from approximately the middle  $\frac{1}{3}$  of the load.

Samples for acceptance will not be taken at the concrete production facility (batch plant), nor prior to discharge from a concrete pump (excluding tremie seal placement applications).

#### 3.02 Suspension Limits

If during the pour the concrete is found to be out of the specifications in Table 3, then the pour shall be stopped until concrete can be provided that meets the project specifications. The Engineer will not pay for items placed with concrete that does not meet the following specifications.

<b>Table 2</b>	
<b>Quality Characteristic</b>	<b>Suspension Limits</b>
Air Content (percent)	<5.0 or >9.0
Air Content Loss (percent)	Greater than 1.5
Concrete Temperature (degrees Fahrenheit)	<45 or >90 at time of placement
Slump	See Table 1

### 3.03 Acceptance

Concrete items will be accepted based on the criteria in the items specification; concrete was placed within the limits of Table 3 and the average of the corresponding 28-day test cylinders being above the design strength.

END OF SECTION 014516.01

SECTION 014516.02  
DENSITY AND AGGREGATE TESTING

PART 1 - GENERAL

1.01 Work Included

This work includes material testing of soil, aggregates, stabilized mixtures, and pulverized pavement mixtures.

1.02 References

- A. Michigan Department of Transportation 2020 Standard Specifications for Construction
- B. Michigan Department of Transportation Density Testing and Inspection Manual
- C. Michigan Department of Transportation Procedures for Aggregate Inspection
- D. Michigan Test Methods (MTM)

1.03 Related Work

- A. Section 017450 – Cleanup and Restoration
- B. Section 312301 – Excavating, Filling, and Grading
- C. Section 321116 – Granular Subbase
- D. Section 321123 – Aggregate Base
- E. Section 321216 – HMA Paving
- F. Section 321300 – Concrete Curb and Gutter, Sidewalk, and Miscellaneous Pavement
- G. Section 330500 – Adjusting Structures
- H. Section 331100 – Water Main
- I. Section 333100 – Sanitary Sewer
- J. Section 334400 – Storm Sewers

1.04 Quality Assurance and Quality Control

- A. Soil and Aggregate Density Testing
  - 1. The Owner is responsible for all onsite density testing on this project. The Owner has the right to determine which materials shall be tested and the frequency of testing.
- B. Sand and Aggregate Gradation

The Contractor is to supply sand and aggregates in the Michigan Department of Transportation gradations, as specified by the project specifications.

Contractors are encouraged to use “prequalified” Michigan Department of Transportation aggregate sources. If the Contractor elects to use a non-prequalified source, then the Contractor shall be responsible for supplying the Engineer with Sieve Analysis (MTM109) and Loss by Washing (MTM108) at the following rates:

Coarse Aggregates	1 per 1,000 tons
Dense-Graded Aggregates	1 per 1,000 tons
Open-Graded Aggregates	1 per 1,000 tons
Granular Material Class I	1 per 1,000 tons
Granular Material Class II and IIA	1 per 3,000 cubic yards
Granular Material Class III	1 per 10,000 cubic yards
Fine Aggregate	1 per 1,000 tons

All Sieve Analysis and Loss by Washing reports shall be signed and sealed by a Professional Engineer.

#### 1.05 Job Conditions

##### A. Access for Testing

The Contractor shall provide the Engineer safe access for testing technicians to complete any required testing. Reasonable time for testing shall be allowed by the Contractor.

##### B. Safety

The Contractor is responsible for conducting operations in a safe and orderly manner and in conformance with MIOSHA P.A. 154.

### PART 2 - PRODUCTS

Not Applicable

### PART 3 - EXECUTION

#### 3.01 Minimum Percent of Compaction for Aggregates

The following are a minimum percent compaction for typical items of work. Note: Higher percent compaction may be required for specific items of work, see specifications for those items.

##### A. Original Ground

Road Embankment Areas	90 percent
Bridges – within the limits as shown on the plans	95 percent

##### B. Cut Areas

Cuts requiring Sand Subbase	95 percent
Cuts not requiring Sand Subbase	95 percent
Subgrade for HMA Base, Aggregate Base, and Concrete Widening	95 percent
Trenches for under HMA Shoulders	98 percent*

C. Embankments and Backfill	
Regular	95 percent* (within top 3 feet)
Abutments with Piling	95 percent
Abutments without Piling	100 percent
Foundation Undercut Backfill	100 percent
Backfill for Bridges, Culverts, Utilities, Manholes, Catch Basins, Edge Drains, and Subgrade Undercuts	95 percent
Foundations and Miscellaneous Structures	95 percent
D. Pavement Structure	
Subbase	95 percent*
Subbase for Slope Paving	90 percent
Aggregate Base under Concrete Pavement	95 percent*
Aggregate Base under HMA Pavement	98 percent*
Pulverized HMA Aggregate Base	98 percent
Recycled Concrete Aggregate Base – under Concrete Pavement	95 percent
Recycled Concrete Aggregate Base – under HMA Pavement	98 percent
Aggregate Base – Sleeper Slab and Bridge Approach	98 percent
Shoulders – Class I	98 percent*
Shoulders – Class II and III	95 percent*
OGDC – used under Concrete and HMA Pavement	95 percent*
OGDC – used under Concrete and HMA Pavement (recycled material)	98 percent*
* May NOT exceed optimum moisture	

### 3.02 HMA Density

The density control target, “Theoretical Maximum Density” (TMD) for HMA shall be calculated using the Gmm from the Contractors approved HMA mix design.  $TMD = Gmm \times 62.4$ .

HMA Base Course	92 percent to 98 percent
HMA Leveling Course	92 percent to 98 percent
HMA Top Course	92 percent to 98 percent

The HMA layer must meet the required density target before the succeeding lift or traffic is placed on the pavement.

### 3.03 Testing Frequency

Each layer must be tested and meet compaction requirements before the succeeding layer is placed. The Engineer will test at a rate that is warranted for field conditions and Contractor means and methods. The list of frequencies below are minimums.

Subgrade	1 test per 500 feet per width of 24 feet or less
Embankment	1 test per 1,000 cubic yards of material and every lift

Subbase	1 test per 500 feet per width of 24 feet or less
Backfill	1 test per 300 cubic yards of material
Aggregate Base Course	1 test per 500 feet per width of 24 feet or less
HMA Mixtures	1 test per 500 feet per width of 24 feet or less
Shoulders	1 test per 1,000 feet each side
Sleeper Slab	1 test per bridge approach per stage
Foundations and Miscellaneous Structures	1 test per 1-foot lift or per 300 cubic yards
Trenching	1 test per 1,000 feet each side

### 3.04 Compaction Efforts

The Contractor shall continue to make compaction efforts to obtain the minimum standards given within this specification upon notification of a failing test. A passing test is required at every location of a failing test prior to starting the next related item of work.

END OF SECTION 014516.02

SECTION 015000  
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 Work Included

This work includes providing temporary facilities and controls during the construction of the project.

1.02 Related Work

A. Section 015726 – Dust Control

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.01 Electricity

Electricity for use by the Contractor during the construction of the project shall be provided by the Contractor. The Contractor shall provide such temporary systems necessary to convey the electricity to the work area from the point of supply.

Temporary power supply systems shall comply with all applicable codes.

3.02 Lighting

The Contractor shall provide lighting for construction activities. The Contractor shall provide fixtures, switches, conductors, and other equipment for a complete system. The lighting system shall meet the requirements of all applicable codes.

Electricity for lighting will be paid for as described in Section 3.01.

3.03 Heat, Ventilation

The Contractor shall provide heat and ventilation, as required, to maintain specified conditions for construction operations and to protect materials, equipment, and finishes from damage due to temperature or humidity.

The Contractor shall provide ventilation of enclosed areas to cure materials, to disperse humidity, and to prevent accumulations of dust, fumes, vapors, or gases.

The Contractor shall provide ventilation of enclosed areas, as necessary, to maintain safe working areas as required by applicable codes.



### 3.04 Water

The Owner will provide water for construction activities, at the location of existing water lines, faucets, and hydrants. The Contractor shall provide such piping extensions, as necessary, to deliver the water to the location(s) required for construction activities.

### 3.05 Barriers

The Contractor shall provide barriers to prevent entry to construction areas or hazardous areas.

### 3.06 Enclosures

The Contractor shall provide temporary weather tight enclosures of openings in exterior surfaces to provide acceptable working conditions, protection of materials from the elements, and to prevent entry of unauthorized persons.

### 3.07 Protection of Installed Work

The Contractor shall control vehicle and pedestrian traffic and/or provide temporary protective coverings, as required, to protect installed or uncompleted work from damage.

### 3.08 Water Control

The Contractor shall grade the site to drain. Excavations shall be kept free of water. The Contractor shall provide pumps as required.

Water shall not be run to detrimentally affect adjacent buildings or properties.

### 3.09 Dust Control

The Contractor shall provide such measures, as necessary, to control dust emanating from the construction area in accordance with Section 015726 – Dust Control.

### 3.10 Cleaning

The Contractor shall maintain the construction area free of debris and waste material. Debris and waste material resulting from construction operations shall be properly disposed of by the Contractor.

The Contractor shall clean areas, as required, for proper execution of the project work.

### 3.11 Drinking Water

The Contractor shall furnish drinking water for their workers.

### 3.12 Sanitary Facilities

The Contractor shall provide sanitary facilities for their workers as required by laws and regulations. The Contractor shall service and clean the facilities as needed or as directed by the Engineer.

END OF SECTION 015000

SECTION 015726  
DUST CONTROL

PART 1 - GENERAL

1.01 Work Included

The Contractor shall provide and maintain adequate measures to control dust from the project area.

1.02 References

Where materials or methods of construction are listed as being in conformance with a standard specification, it shall refer to the latest edition of the standard specification or any interim revision.

- A. ASTM D98 – Standard Specification for Calcium Chloride
- B. Michigan Department of Transportation 2020 Standard Specifications for Construction

1.03 Related Work

- A. Section 015000 – Construction Facilities and Temporary Controls
- B. Section 312301 – Excavating, Filling, and Grading
- C. Section 312500 – Soil Erosion and Sedimentation Control

PART 2 - PRODUCTS

2.01 Materials

- A. Dust palliative shall be calcium chloride conforming to ASTM D98, except as modified here:  
Calcium chloride solids shall have a minimum concentration of 77 percent  $\text{CaCl}_2$ , and may be of any gradation provided that all particles will pass a  $\frac{3}{8}$ -inch sieve, and that less than 5 percent pass a No. 30 sieve. Calcium chloride liquid must be furnished in solution with a concentration of 33, 35, or 38 percent  $\text{CaCl}_2$ .

At the time of delivery, the Engineer shall be provided a delivery report with the following information:

1. The volume in gallons or weight of solution delivered, or the weight of solids delivered.
2. The concentration of solids or solution delivered, expressed as the percent of  $\text{CaCl}_2$ .
3. The equivalent tons of calcium chloride,  $\text{CaCl}_2$ . The equivalent weight of calcium chloride shall be determined in accordance with Table 922-2, of the Michigan Department of Transportation 2020 Standard Specifications for Construction.

### PART 3 - EXECUTION

#### 3.01 Requirements for Dust Control Measures

The Contractor shall provide adequate dust control measures to prevent dust from the construction area from being a health or safety hazard or a nuisance. The Contractor is responsible for control of dust from the construction area, even if the dust is caused by traffic other than the Contractor's operations.

The Contractor shall maintain the dust control measures through the life of the project.

When, in the Engineer's opinion, the Contractor's measures for the control of dust are inadequate, the Engineer will provide notice to the Contractor to take such measures as necessary to control the dust. If the Contractor fails to provide for the required controls, the Engineer may make arrangements for providing dust control measures by another party, and deduct the cost thereof from the Contractor's earnings.

#### 3.02 Application

Water or dust palliative shall be uniformly applied to exposed soil areas which may be the source of dust. The application(s) shall be repeated as necessary to control dust emanating from the project area. If water is used, it shall be applied at a rate to not cause mud to be tracked out of the project limits.

END OF SECTION 015726

SECTION 01 71 13  
MOBILIZATION

PART 1 - GENERAL

1.01 Work Included

Mobilization consists of preparatory work and operations, including but not limited to the following:

- A. The movement of people, equipment, and materials to the project site;
- B. The establishment of the Contractor's facilities to work on the project (offices, storage yards, borrow and disposal sites, etc.);
- C. Expenses incurred prior to beginning work on specific contract pay items;
- D. Pre-construction costs (not bidding costs) which are direct costs to the project, rather than direct costs to specific pay items.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.01 Mobilization

Following Notice of Award, the Contractor shall expeditiously prosecute such work necessary for execution of the contract.

Following Notice to Proceed, the Contractor shall commence such work necessary to prepare for the beginning work on the project.

END OF SECTION 017113

SECTION 017123.16  
CONSTRUCTION STAKING BY CONTRACTOR

PART 1 - GENERAL

1.01 Work Included

The Contractor is responsible to provide all staking and layout necessary for construction of the project.

1.02 Notifications

In the event that it appears there is an error or contradiction between plan grades, construction stakes, and/or actual conditions, the Contractor shall notify the Owner or Engineer immediately.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.01 Requirements

The Contractor is responsible to provide such layout and control work as may be required for construction of the proposed improvements.

The Contractor shall provide workers competent in the layout and control work necessary. The Contractor shall provide the equipment and materials necessary for establishing the necessary control and layout.

Pipelines, 8 inches or larger that are to be laid at a uniform grade, shall be laid using a laser for alignment control.

3.02 Plan Grades and Alignment

The horizontal alignment of manholes and drainage structures will be from the center of casting, unless otherwise noted.

Final casting elevation for drainage structures and manholes shall be determined by the Engineer after grading is completed.

END OF SECTION 017123.16

SECTION 017450  
CLEANUP AND RESTORATION

PART 1 - GENERAL

1.01 Work Included

The Contractor shall restore areas disturbed by construction activities to a condition reasonably close to their condition before the project, unless shown otherwise on the plans. Restoration work should be performed as soon as possible after construction work is completed in a particular area.

Upon the completion of work in an area, all excess materials, debris, equipment, and similar items shall be removed from the project area by the Contractor and disposed of properly.

1.02 Related Work

- A. Section 014516.02 – Density and Aggregate Testing
- B. Section 312500 – Soil Erosion and Sedimentation Control
- C. Section 321123 – Aggregate Base
- D. Section 321216 – HMA Paving
- E. Section 321300 – Concrete Curb and Gutter, Sidewalk, and Miscellaneous Pavement
- F. Section 329200 – Turf Establishment

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.01 Restoration

Unless otherwise provided, aggregate surfaces, HMA pavements, and concrete pavements shall be restored by construction of similar replacement surfaces. Aggregate surfaces shall be replaced with the materials and thicknesses described in the specification for aggregate surfaces or as shown on the drawings. HMA pavement shall be replaced with the cross sections(s) shown on the plans and in accordance with Section 321216 – HMA Paving. Concrete pavement shall be replaced with pavement in accordance with Section 321300 – Concrete Curb and Gutter, Sidewalk, and Miscellaneous Pavement.

Turf areas shall be restored by re-establishing the turf as described in Section 329200 – Turf Establishment. All areas disturbed by construction that are not to be surfaced with aggregate or pavement shall be restored with turf, unless otherwise directed.

Mailboxes, fences, signs, ornaments, and similar items shall be replaced at the completion of construction. Posts shall be installed plumb. Items that are lost or stolen shall be repaired or replaced at the Contractor's expense. Repairs or replacements shall meet the Owner's approval.

### 3.02 Temporary Restoration of Driving Surfaces

Where a pavement or gravel surface is removed as a result of construction activities, a temporary surface shall be provided and maintained by the Contractor until the permanent surface is provided. Unless otherwise directed, the temporary surface shall be 8 inches of aggregate compacted according to Section 014516.02 – Density and Aggregate Testing and graded to meet the adjacent, remaining surfaces. Aggregate shall meet the requirements of Series 23A as described in the Michigan Department of Transportation 2020 Standard Specifications for Construction. Recycled HMA may also be utilized after approval of material by the Engineer.

The Contractor shall regrade the temporary surface and add additional aggregate periodically, as necessary, to maintain them in a relatively smooth condition.

END OF SECTION 017450



SECTION 024113.13  
PAVEMENT REMOVAL

PART 1 - GENERAL

1.01 Work Included

This work includes removal of an existing pavement, including streets, driveways, sidewalks, curb and/or gutter, and parking areas. For purposes of the work "pavement removal", pavement material may include HMA, concrete, brick, or any combination thereof, including any reinforcement materials.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.01 Limits of Removal

Pavement shall be removed to the limits shown on the plans, or as directed by the Engineer in the field. Where pavement is to be removed to allow for the construction of utilities or other improvements, pavement shall be removed to the limits required for their construction.

3.02 Pavement Removal (Including Curb and Gutter Removal)

Pavement shall be removed to an existing joint or to a sawed joint. An existing crack is not suitable for the limit of removal. Sawed joints for pavement removal are to be either parallel or perpendicular to the longitudinal centerline. Sawed joints shall extend substantially through the full thickness of the pavement so that a "clean break" is made and that the adjacent pavement or structures that are to remain are not damaged. If adjacent pavement or structures that are to remain are damaged as a result of the Contractor's removal operations, they shall be replaced to the Owner's satisfaction at the Contractor's expense.

Curb and gutter removal shall be as directed by the Engineer. The Contractor shall sawcut existing curb and/or gutter perpendicular to and completely through the existing concrete.

Broken concrete, HMA, brick, and other debris resulting from pavement removal operations shall become the Contractor's property and disposed of properly.

Where pavements are encountered that are composed of more than one material or multiple courses of the same material, the pavement shall be removed in its entirety and all components shall be considered part of the same pavement area.

The Contractor shall provide sufficient barricades and fences to protect pedestrians and vehicles from hazardous areas.

END OF SECTION 024113.13

## SECTION 024119 - SELECTIVE DEMOLITION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Demolition and removal of selected portions of building or structure.
  - 2. Demolition and removal of selected site elements.
  - 3. Salvage of existing items to be reused or recycled.

#### 1.2 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, similar objects and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
  - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property for dust control. Indicate proposed locations and construction of barriers.
- B. Schedule of selective demolition activities with starting and ending dates for each activity.

#### 1.4 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is expected that hazardous materials are present at the site, but they will be removed by the Owner's abatement contractor under a separate contract prior to the work of this contract.
  - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify the Construction Manager and the Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.
- G. Arrange selective demolition schedule so as not to interfere with Owner's operations.

#### 1.5 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

### 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. If required, arrange to shut off utilities with utility company.
  - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  - 3. Disconnect, demolish, and remove plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
    - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    - b. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    - c. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    - d. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    - e. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

### 3.3 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
- C. Remove temporary barricades and protections where hazards no longer exist.

### 3.4 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
  2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  4. Maintain fire watch during and for at least two (2) hours after flame-cutting operations.
  5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  6. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until delivery to Owner.
  4. Transport items to Owner's storage area designated by Owner.
  5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
  2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  3. Protect items from damage during transport and storage.
  4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

### 3.5 CLEANING

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
1. Do not allow demolished materials to accumulate on-site.
  2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn demolished materials.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

## SECTION 033000 - CAST-IN-PLACE CONCRETE (FOR BUILDING CONSTRUCTION)

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following:
  - 1. Concrete foundation walls, piers and footings.
  - 2. Concrete sills.
  - 3. Concrete slabs-on-grade.
  - 4. Installation (only) of sleeves for other trades.
  - 5. Equipment pads and bases.
- B. Related Requirements:
  - 1. Section 311000 "Concrete Forming (For Site Construction)" for forming of all site concrete work.
  - 2. Section 315000 "Concrete Accessories (For Site Construction)" for concrete accessories for all site concrete work.
  - 3. Section 320000 "Concrete Reinforcing (For Site Construction)" for reinforcing of all site related concrete work.
  - 4. Section 033000 "Cast-in-Place Concrete (For Site Construction)" for all site concrete work.
  - 5. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.
  - 6. Section 072100 "Thermal Insulation" for perimeter insulation.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Design Mixtures: For each concrete mixture.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures."

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Material certificates.
- B. Material test reports.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

## 1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

## 1.6 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1.
  - 1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M).

## PART 2 - PRODUCTS

### 2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301 (ACI 301M).
  - 2. ACI 117 (ACI 117M).

### 2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

### 2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- C. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

### 2.4 CONCRETE MATERIALS

- A. Cementitious Materials:
  - 1. Portland Cement: ASTM C 150/C 150M, Type I.
  - 2. Fly Ash: ASTM C 618, Class F or C.
  - 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33/C 33M, graded.
  - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches for foundations and 3/4 inch typical other locations and applications.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Air-Entraining Admixture: ASTM C 260/C 260M.

- D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  - 5. Crystalline Waterproofing Additive: Xypex Admix C-500/C-500NF.
  - 6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  - 7. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- E. Water: ASTM C 94/C 94M and potable.

## 2.5 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.
- B. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick.

## 2.6 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

## 2.7 FLOOR HARDENER MATERIALS

- A. Magnesium fluorosilicate concrete hardener and dustproofers: MasterKure HD 300WB.
- B. Provide at all floors where the floor finish is called out to be "sealed concrete".

## 2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

## 2.9 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).
- B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.



1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
  2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  3. Use water-reducing admixture in pumped concrete, concrete required to be watertight, and concrete with a w/c ratio below 0.50.
- D. Waterproofing Additive: (Use only as Fire Pump Cistern floor and walls).
1. Use waterproofing additive according to manufacturer's written instructions.
  2. Crystalline dosage to be not less than 2%-3% by weight of cement content.

## 2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: at 28 days as follows:
    - a. Footings, Foundation Walls and Piers: 3,000 psi.
    - b. Interior Slabs on Grade and Concrete toppings: 3,500 psi.
    - c. Entry slabs: 4,500 psi.
  2. Maximum Water- Cementitious Materials Ratio:
    - a. For 3,000 psi = 0.5 air entrained and 0.68 non air entrained.
    - b. For 3,500 psi = 0.5 air entrained and .62 elsewhere.
    - c. For 4,500 psi = 0.4 air entrained.
  3. Slump Limit: 4 inches plus or minus 1 inch.

## 2.11 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."
- B. Conform with requirements of ACI 315 where specific details are not shown or where the drawings and specifications are not more demanding.
- C. Bundle, tag and mark all reinforcement. Use metal tags indicating bar size, lengths and other information corresponding to markings shown on shop drawings.

## 2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
  2. Add Waterproofing additive at anytime of batching. Do not add dry additive to wet concrete.

## PART 3 - EXECUTION

### 3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).
- C. Chamfer exterior corners and edges of permanently exposed concrete.

### 3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

### 3.3 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
  - 1. Lap joints 6 inches (150 mm) and seal with manufacturers recommended tape.

### 3.4 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
  - 2. Accurately position, support and secure reinforcement against displacement by formwork, construction or concrete placement operations. Provide supports for reinforcement including bolsters, chairs, spacers and other devices suitable for proper spacing, supporting and fastening reinforcing in place. Use wire bar type supports complying with CRSI "Manual of Standard Practice".
  - 3. Use minimum #5 carrying bars where required.
  - 4. Use supports with sand plates horizontal runners for slabs on grade where base materials shall not support chair legs.
  - 5. Space reinforcing bars to comply with ACI 318.
  - 6. Relocate bars to avoid interference of other embedded items but not more than one bar diameter without approval.
  - 7. Locate last reinforcing bar within 2 inches of last leg of continuous bar support.
  - 8. Place reinforcement to obtain proper coverage for concrete protection. Arrange, space and tie bars and bar supports together with steel wire. Set wire tie ends to concrete. Place and tie column dowels.
  - 9. Splice reinforcement with contact lapped splices in accordance with ACI 318 Class B considering both basic and top bar tables, unless indicated otherwise on the drawings.
  - 10. Protect installed reinforcing from construction loads.

### 3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
  - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

### 3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
  - 1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
- C. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Slope surfaces uniformly to drains where required.

### 3.7 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
  - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
  - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
  - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
  - 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

### 3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
  - 1. Apply float finish to surfaces to receive trowel finish.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  - 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
  - 2. Finish and measure surface, so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch (4.8 mm).
- D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.
  - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
  - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

### 3.9 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 (ACI 301M) for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Cure concrete scheduled to receive a liquid hardener as specified in paragraph 3.11.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy

rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

- a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

### 3.10 APPLICATION OF LIQUID HARDENERS

- A. Cure concrete surfaces scheduled to receive a liquid hardener by the following method and as directed by the liquid hardener manufacturer:
  1. Water curing following the guidelines in ACI 308, "Standard Practice for Curing Concrete."
- B. Apply three (3) coats of liquid hardener per manufacturer's written instructions to achieve the appearance of a polished sheen.
- C. Mask any glass, aluminum or polished metal surfaces in the application area as well as any contraction or control joints that have not been filled to prevent possible adhesion problems.
- D. All surfaces to be treated with the liquid hardener must be dry, clean, and free of all dust, dirt, debris, oil, grease, sealers, or curing compounds.
- E. Apply the first coat of liquid hardener by roller, spray, brush, or squeegee. Bubbling indicates reaction of MasterKure HD 300WB with the concrete. Distribute evenly and mop up excess solution or puddles.
- F. After the first application, allow the floor to dry until no longer visibly wet.
- G. If crystals develop during the second application, flush the surface liberally with clean water. Use hot water if available. At the same time, rapidly brush the floor with a stiff-bristled broom.
- H. Mop up excess water and allow the surface to dry.
- I. As the last application is drying, wait for the uniform appearance of white crystals. Flood the floor with water and buff with a commercial floor buffer using an abrasive pad. Continue buffing until the floor acquires a patina or polish and the whiteness is gone.

### 3.11 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

### 3.12 FIELD QUALITY CONTROL

- A. Special Inspections: The General Contractor will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION 033000

## SECTION 042000 - UNIT MASONRY

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Concrete masonry units.
  - 2. Decorative concrete masonry units.
  - 3. Clay face brick.
  - 4. Mortar and grout.
  - 5. Steel reinforcing bars.
  - 6. Masonry-joint reinforcement.
  - 7. Ties and anchors.
  - 8. Embedded flashing.
  - 9. Miscellaneous masonry accessories.
  - 10. Cavity wall insulation.
  - 11. Cavity wall air and vapor barrier.
  - 12. Masonry waste disposal.
- B. Products Installed but not Furnished under this section:
  - 1. Steel lintels in unit masonry.

#### 1.2 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For reinforcing steel. Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.
- C. Samples for Verification: For each type and color of exposed masonry unit and colored mortar (at Alternate No. 5).

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of product. For masonry units, include material test reports substantiating compliance with requirements.
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
  - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
  - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

## 1.5 QUALITY ASSURANCE

- A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
  - 1. Build sample panels for typical exterior wall in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high by full thickness.

## 1.6 FIELD CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

## PART 2 - PRODUCTS

### 2.1 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
  - 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

### 2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
  - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- B. CMUs: ASTM C 90.
  - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3,050 psi (21.0 MPa).
  - 2. Density Classification: Normal weight.

### 2.3 DECORATIVE CONCRETE MASONRY UNITS: ASTM C90

- A. Manufacturer: Tri-City Block & Brick, Inc. Swanton, Ohio.
- B. Shapes: Provide split-faced finish and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
  - 1. Provide special shapes for lintels, corner, jambs, sashes, movement joint, headers, bonding and other special conditions.

- C. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3050 psi (31.0 MPa).
- D. Density Classification: Normal weight.
- E. Water Repellant Admixture: "DRY-BLOCK" as manufactured by Grace Construction Products.
- F. Color to be selected by the Architect from manufacturer's standard aggregate finishes, including premium white colors.

## 2.4 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
  - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
  - 2. Provide square-edged units for outside corners.
- B. Clay Face Brick: Facing brick complying with ASTM C 216.
  - 1. Manufacturer and Product: Subject to compliance with requirements: match existing color/texture/size
  - 2. Grade: SW.
  - 3. Type: FBX.
  - 4. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 psi (23.10 MPa).
  - 5. Initial Rate of Absorption: Less than 20 g/30 sq. in. (20 g/194 sq. cm) per minute when tested according to ASTM C 67.
  - 6. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
  - 7. Size: Bricks manufactured to the following actual dimensions within tolerances specified in ASTM C 216:
    - a. Brick Type 'A': Utility: 3-1/2 to 3-5/8 inches thick by 3-5/8 inches high by 11-5/8 inches long.
    - b. Brick Type 'B': Modular: 3-1/2 to 3-5/8 inches thick by 2-1/4 inches high by 7-1/2 to 7-5/8 inches long (used only to patch areas in the exiting building).

## 2.5 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C 91/C 91M.
- E. Colored Cement Products: Packaged blend made from Portland cement and hydrated lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
  - 1. Water Repellant Admixture (only at colored mortar applications): "DRY-BLOCK" as manufactured by Grace Construction Products.
- F. Aggregate for Mortar: ASTM C 144.



1. For joints less than 1/4-inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
2. White-Mortar Aggregates: Natural white sand or crushed white stone.
- G. Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in the Article; combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C1142.
- H. Aggregate for Grout: ASTM C 404.
- I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- J. Water: Potable.

## 2.6 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
- B. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.
  1. Interior Walls: Galvanized carbon steel, ASTM A641, Class I, (0.1 oz. zinc coating per sq. ft.)
  2. Exterior Walls: Hot-dip galvanized carbon steel, ASTM A153, Class B-2, (1.5 oz. zinc coating per sq. ft.)
  3. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
  4. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
  5. Wire Size for Veneer Ties: 0.148-inch (3.77-mm) diameter.
  6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
  7. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.
- C. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods.
- D. Masonry-Joint Reinforcement for Multiwythe Masonry:
  1. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches (100 mm) wide, plus one side rod at each wythe of masonry 4 inches (100 mm) wide or less.
  2. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch (1.5 mm) and maximum vertical adjustment of 1-1/4 inches (32 mm). Size ties to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

## 2.7 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches (38 mm) into veneer but with at least a 5/8-inch (16-mm) cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
  1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
  2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
  3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

- C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.
  - 1. Wire: Fabricate from 3/16-inch- (4.76-mm-) diameter, hot-dip galvanized-steel wire.
- D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
  - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.35-mm-) diameter, hot-dip galvanized-steel wire.
  - 2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized-steel wire.
- E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.35 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated.
  - 1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M Epoxy coating 0.020 inch (0.51 mm) thick.
- F. Adjustable Masonry-Veneer Anchors:
  - 1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf (445-N) load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch (1.5 mm).
  - 2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.075-inch- (1.90-mm-) thick steel sheet, galvanized after fabrication.
  - 3. Fabricate wire ties from 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized-steel wire unless otherwise indicated.
  - 4. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a rib-stiffened, sheet metal anchor section.
  - 5. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a gasketed sheet metal anchor section, with pronged legs of length to match thickness of insulation or sheathing and raised rib-stiffened strap to provide a slot for inserting wire tie.

## 2.8 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
  - 1. Fabricate metal flashing from type 304 stainless steel: 7" x 1" upturned leg with 45 degree hemmed drip. Extend drip 3/4 inch out from wall.
  - 2. Fabricate metal sealant stops from stainless steel. Extend full width of flashing into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.
  - 3. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
- B. Flexible Flashing: Use one of the following over stainless steel flashing unless otherwise indicated:
  - 1. Copper-Laminated Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) copper sheet bonded between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
    - a. Products: Subject to compliance with requirements, provide one of the following:
      - 1) Advanced Building Products Inc.; Copper Fabric Flashing.
      - 2) Dayton Superior Corporation, Dur-O-Wal Division; Copper Fabric Thru-Wall Flashing.
      - 3) Hohmann & Barnard, Inc.; H & B C -Fab Flashing.
      - 4) York Manufacturing, Inc.; Multi-Flash 500.

2. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch (0.76 mm). Use only where flashing is fully concealed in masonry.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) Advanced Building Products Inc.; Peel-N-Seal.
    - 2) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
    - 3) Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.
    - 4) Grace Construction Products, W.R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
    - 5) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
    - 6) Hohmann & Barnard.; Textroflash.
    - 7) W.R. Meadows, Inc.; Air-Shield Thru-Wall Flashing.
    - 8) Williams Products, Inc.; Everlastsic MF-40.
  - C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
  - D. Formed Weep Vent: Masonpro (Cell Vents) insertable weep/air vent

## 2.9 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene or urethane.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).
- D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
  1. Configuration: Provide the following:
    - a. Strips, full depth of cavity and 10 inches (250 mm) high, with dovetail shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.

## 2.10 CAVITY WALL INSULATION

- A. Extruded Polystyrene Board, ASTM C 578-, Type IV, 25 psi minimum compressive strength, unfaced, R5.6 per inch. Provide thickness as indicated on the drawings.
  1. Basis-of-Design: Styrofoam Cavitymate Ultra Extruded Polystyrene Foam Insulation as manufactured by The Dow Chemical Company.
  2. Equal products as manufactured by one of the following companies are also acceptable:
    - a. DiversiFoam Products.
    - b. Owens Corning.
- B. Adhesive and Joint Filler: Type as recommended and approved by the insulation manufacturer

2.11 CAVITY WALL AIR AND VAPOR BARRIER

- A. Fluid applied, one component, latex based membrane that cures to form a resilient, monolithic, fully bonded elastomeric sheet.
- B. Basis-of-Design: Perm-A-Barrier NPL10 as manufactured by Grace Construction.
  - 1. Minimum wet thickness: 70 mils (40 mils dry).

2.12 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Diedrich Technologies, Inc.
    - b. EaCo Chem, Inc.
    - c. ProSoCo, Inc.

2.13 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
  - 1. Do not use calcium chloride in mortar or grout.
  - 2. Use portland cement-lime or masonry cement mortar unless otherwise indicated.
  - 3. For exterior masonry, use portland cement-lime or masonry cement mortar.
  - 4. For reinforced masonry, use portland cement-lime or masonry cement mortar.
  - 5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
  - 1. For masonry below grade or in contact with earth, use Type M.
  - 2. For reinforced masonry, use Type S.
  - 3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type S.
  - 4. For interior nonload-bearing partitions, Type N.
  - 5. For all exterior brick veneer use Type N.
- D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
  - 1. Pigments shall not exceed 10 percent of portland cement by weight.
  - 2. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
  - 3. Mix to match approved samples.
  - 4. Application: Use pigmented mortar for exposed mortar joints with the following units:
    - a. Decorative concrete masonry units.

- E. Water Repellant Admixture: Provide water repellant admixture at all colored mortar applications for integrally colored split-faced block (at Alternate No. 5).
  - 1. Mix water repellant admixture as recommended by the Manufacturer.
- F. Grout for Unit Masonry: Comply with ASTM C 476.
  - 1. Proportion grout in accordance with ASTM C 476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
  - 2. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

### 3.2 TOLERANCES

- A. Dimensions and Locations of Elements:
  - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
  - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
  - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.
- B. Lines and Levels:
  - 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
  - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
  - 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
  - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
  - 5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
- C. Joints:
  - 1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
  - 2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
  - 3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

### 3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- E. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

### 3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick and CMUs as follows:
  - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
  - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
  - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
  - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

### 3.5 CAVITY WALLS

- A. Bond wythes of cavity walls together as follows:
  - 1. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.
    - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
    - b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties.
    - c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- C. Install Cavity Wall Insulation per insulation manufacturers recommendations and as follows:
  - 1. Apply 2" diameter daubs of adhesive spaced approximately 12" o.c. both ways on inside face of insulation board.
  - 2. Butter all edges of insulation board with adhesive to provide continuous vapor barrier.

3. Fit insulation between wall ties and other obstructions with joints staggered and edges butted tightly.
  - a. Press units firmly against inside wythe of masonry or other construction.
  - b. Make insulation continuous. Fill all voids with joint filler.

### 3.6 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
  1. Space reinforcement not more than 16 inches (406 mm) o.c.
  2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
  3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

### 3.7 CAVITY WALL AIR AND VAPOR BARRIER

- A. Prepare surfaces according to manufacturer's recommendations.
- B. Install fluid applied membrane per manufacturer's instructions.
- C. Comply with manufacturer's requirements for limiting exposure time.

### 3.8 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
  1. Provide an open space not less than 1/2 inch (13 mm) 1 inch (25 mm) 2 inches (50 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
  2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
  3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

### 3.9 FLASHING, WEEP HOLES, AND CAVITY VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
  1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
  2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches (200 mm), and through inner wythe to within 1/2 inch (13 mm) of the interior face of wall in exposed masonry. Where interior face of

wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches (50 mm) on interior face.

3. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
  4. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
  5. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
- C. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing- Formed Weep Vent: Masonpro (Cell Vents) insertable weep/air vent
1. Use open head joints to form weep holes.
  2. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.
- D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

### 3.10 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
  2. Limit height of vertical grout pours to not more than 48 inches (1220 mm).

### 3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: The Construction Manager will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Level 1 special inspections according to the Michigan Building Code.
1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
  2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
  3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.



- D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.
- E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.
- F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- H. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- I. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

### 3.12 REPAIRING, POINTING, AND CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
  - 3. Protect adjacent surfaces from contact with cleaner.
  - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
  - 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
  - 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

### 3.13 MASONRY WASTE DISPOSAL

- A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
  - 1. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

## SECTION 051200 - STRUCTURAL STEEL FRAMING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Structural steel.
  - 2. Grout.

#### 1.2 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication of structural-steel components.
  - 1. Include erection plans, all connection details, splices, camber, holes and other pertinent data.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Welding certificates.

#### 1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC172) or abides by an equivalent control and inspection program.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Comply with applicable provisions of the following specifications and documents:
  - 1. AISC 303.
  - 2. AISC 360.
  - 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.
  - 1. Select and complete connections using schematic details indicated and AISC 360.
  - 2. Use Allowable Strength Design; data are given at service-load level.

- B. Moment Connections: Type FR, fully restrained.
- C. Construction: Combined system of moment frames and shear walls.

## 2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
- F. Welding Electrodes: Comply with AWS requirements.

## 2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
  - 1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.
- B. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
  - 1. Configuration: Hooked.
  - 2. Finish: Plain.
- C. Headed Anchor Rods: ASTM F 1554, Grade 36 straight.
  - 1. Finish: Plain.
- D. Threaded Rods: ASTM A 36/A 36M.
  - 1. Finish: Plain.
- E. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.
- F. Tie Rods: ASTM 722.
  - 1. Finish: Plain, galvanized and threaded at piers.

## 2.4 PRIMER

- A. Primer: SSPC-Paint 25, Type I, zinc oxide, alkyd, linseed oil primer.
- B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

## 2.5 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## 2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.

## 2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

## 2.8 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
  - 2. Surfaces to be field welded.
  - 3. Surfaces of high-strength bolted, slip-critical connections.
  - 4. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
  - 1. SSPC-SP 2, "Hand Tool Cleaning."
  - 2. SSPC-SP 3, "Power Tool Cleaning."
  - 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

## 2.9 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
  - 1. Coordinate required vent holes with galvanizer. Fill, grind smooth and apply zinc rich coating after galvanizing.
  - 2. Galvanize all steel exposed to the exterior including lintels.

## 2.10 SOURCE QUALITY CONTROL

- A. Testing Agency: The Construction Manager will engage a qualified testing agency to perform shop tests and inspections.
  - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
  - 1. Liquid Penetrant Inspection: ASTM E 165.
  - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.

3. Ultrasonic Inspection: ASTM E 164.
  4. Radiographic Inspection: ASTM E 94.
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  1. Set plates for structural members on wedges, shims, or setting nuts as required.
  2. Weld plate washers to top of baseplate.
  3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Do not use thermal cutting during erection.
- E. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

#### 3.3 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
  3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: The Construction Manager will engage a qualified independent testing and inspecting agency to inspect field welds and high strength bolted connections.
- B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
  - 1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
    - a. Liquid Penetrant Inspection: ASTM E 165.
    - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
    - c. Ultrasonic Inspection: ASTM E 164.
    - d. Radiographic Inspection: ASTM E 94.
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- E. Repair coatings as follows:
  - 1. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions. Brush or hand applied, spray cans not permitted.
  - 2. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories and abutting structural steel.
    - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power tool cleaning.
    - b. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION 051200

## SECTION 052100 - STEEL JOIST FRAMING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. K-series steel joists.
2. K-series steel joist substitutes.
3. LH- and DLH-series long-span steel joists.
4. Joist girders.
5. Joist accessories.

#### 1.2 ACTION SUBMITTALS

##### A. Product Data: For each type of joist, accessory, and product.

##### B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

##### C. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.

#### 1.3 INFORMATIONAL SUBMITTALS

##### A. Welding certificates.

##### B. Manufacturer certificates.

##### C. Mill Certificates: For each type of bolt.

##### D. Field quality-control reports.

#### 1.4 QUALITY ASSURANCE

##### A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

- B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

## PART 2 - PRODUCTS

A.

### 2.2 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
- B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

### 2.3 PRIMERS

- A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

### 2.4 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
- B. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface unless otherwise indicated.
- C. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.
  - 1. Finish: Plain
- D. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

### 2.5 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories.
- B. Apply one coat of shop primer to joists and joist accessories.



## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written instructions, and requirements in this Section.
  - 1. Before installation, splice joists delivered to Project site in more than one piece.
  - 2. Space, adjust, and align joists accurately in location before permanently fastening.
  - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
- C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Bolt joists to supporting steel framework using carbon-steel bolts.
- E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.
- F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

### 3.2 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Visually inspect field welds according to AWS D1.1/D1.1M.
- C. Visually inspect bolted connections.
- D. Prepare test and inspection reports.

END OF SECTION 052100

## SECTION 053100 - STEEL DECKING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Roof deck.
  - 2. Composite floor deck.
  - 3. Non-composite form deck.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Sustainable Design Submittals:
  - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- C. Shop Drawings:
  - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of steel deck.
- C. Evaluation reports.
- D. Field quality-control reports.

#### 1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

### 2.2 ROOF DECK

- A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
  1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 (230) minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
    - a. Color: Manufacturer's standard.
  2. Deck Profile: Type WR, wide rib.
  3. Profile Depth: 1-1/2 inches (38 mm).
  4. Design Uncoated-Steel Thickness: 0.0358 inch (0.91 mm).

### 2.3 COMPOSITE FLOOR DECK

- A. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
  1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), **G60 (Z180)** zinc coating.
  2. Profile Depth: As indicated.
  3. Design Uncoated-Steel Thickness: As indicated.

### 2.4 NONCOMPOSITE FORM DECK

- A. Noncomposite Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
  1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230) G 60 zinc coating.
  2. Profile Depth: As indicated.
  3. Design Uncoated-Steel Thickness: As indicated.

## 2.5 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.
- G. Galvanizing Repair Paint: ASTM A 780/A 780M.
- H. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- C. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- D. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- E. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- F. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.
- G. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches (305 mm) apart with at least one weld at each corner.

- H. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
  - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- I. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.
- J. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

### 3.2 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Prepare test and inspection reports.

### 3.3 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

END OF SECTION 053100

## SECTION 054000 - COLD-FORMED METAL FRAMING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Exterior non-load-bearing wall framing.

#### 1.2 ACTION SUBMITTALS

##### A. Product Data: For each type of cold-formed steel framing product and accessory.

##### B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

##### C. Delegated-Design Submittal: For cold-formed steel member sizing and connections indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.3 INFORMATIONAL SUBMITTALS

##### A. Welding certificates.

##### B. Product test reports.

#### 1.4 QUALITY ASSURANCE

##### A. Product Tests: Mill certificates or data from a qualified independent testing agency.

##### B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

##### C. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

- D. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
  - 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

## PART 2 - PRODUCT

### 2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
  - 1. ClarkDietrich Building Systems.
  - 2. SCAFCO Corporation.
  - 3. United Metal Products, Inc.

### 2.2 PERFORMANCE REQUIREMENTS

- A. AISI Specifications and Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200.
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency.
  - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

### 2.3 COLD-FORMED STEEL FRAMING MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
  - 1. Grade: As required by structural performance.
  - 2. Coating: G60 (Z180) Galvanized.

### 2.4 NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm) minimum.
  - 2. Flange Width: 1-5/8 inches (41 mm) minimum.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.
- C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
- F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

## 2.5 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

## 2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
  - 1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

## 2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: MIL-P-21035B or SSPC-Paint 20.
- B. Cement Grout: Portland cement, ASTM C 150/C 150M, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C 1107/C 1107M, and with a fluid consistency and 30-minute working time.



- D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.
- B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

### 3.2 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
- D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- E. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- F. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- G. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- H. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

### 3.3 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
  - 1. Stud Spacing: 16 inches.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
  - 1. Install single deep-leg deflection tracks and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
  - 1. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

### 3.4 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

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END OF SECTION 054000

## SECTION 055000 - METAL FABRICATIONS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Miscellaneous steel framing and supports.
2. Shelf angles.
3. Miscellaneous steel trim.
4. Loose bearing and leveling plates.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

D. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders.

- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

## 2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- E. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- G. Zinc-Coated Steel Wire Rope: ASTM A 741.
  - 1. Wire-Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- H. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
  - 1. Size of Channels: **As indicated.**
  - 2. Material: Galvanized steel, ASTM A 653/A 653M, with G90 (Z275) coating.
- I. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
- J. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- K. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- L. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

## 2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
  - 1. Provide stainless-steel fasteners for fastening aluminum.
  - 2. Provide stainless-steel fasteners for fastening stainless steel.

3. Provide stainless-steel fasteners for fastening nickel silver.
  4. Provide bronze fasteners for fastening bronze.
- B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
  2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy [Group 1 (A1)] [Group 2 (A4)] stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- D. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

#### 2.4 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- B. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

## 2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
- C. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
- E. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c.

## 2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
- C. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
  - 1. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches (600 mm) o.c.
- D. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

## 2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.

## 2.8 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

## 2.9 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
- B. Galvanize loose steel lintels located in exterior walls.

## 2.10 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

## 2.11 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.

## 2.12 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  - 1. Shop prime with universal shop primer.
- C. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.



## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

### 3.2 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### 3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

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END OF SECTION 055000

## SECTION 055100 - METAL STAIRS AND RAILINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Preassembled steel stairs with metal pans for concrete-filled treads (by Div. 3 trades).
  - 2. Steel tube handrails attached to walls adjacent to metal stairs and ramps.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For metal pan stairs, grout and anchoring cement.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

#### 1.3 QUALITY ASSURANCE

- A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
  - 1. Preassembled Stairs: Commercial class.
  - 2. Industrial- Type Stairs: Industrial class.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
  - 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
  - 3. Uniform and concentrated loads need not be assumed to act concurrently.
  - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
  - 5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4inch (6.4 mm), whichever is less.
- B. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
    - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Infill of Guards:
    - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
    - b. Infill load and other loads need not be assumed to act concurrently.

## 2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: ASTM A 500 (cold formed).
- D. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard weight (Schedule 40), unless another grade and weight are required by structural loads.
  - 1. Provide galvanized finish for exterior installations.
- E. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed.
- F. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30 (Grade 205), unless another grade is required by design loads.

## 2.3 FASTENERS

- A. Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
  - 1. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.

## 2.4 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
- B. Provide anchors for embedding units in concrete or CMU walls, either integral or applied to units, as standard with manufacturer.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

## 2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
  - 1. Join components by welding unless otherwise indicated.
  - 2. Use connections that maintain structural value of joined pieces.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Weld connections to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Weld exposed corners and seams continuously unless otherwise indicated.
  5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 3 welds: partially dressed weld with spatter.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

## 2.6 STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Commercial Class, unless more stringent requirements are indicated.
- B. Stair Framing:
1. Fabricate stringers of steel channels.
    - a. Provide closures for exposed ends of channel stringers.
  2. Construct platforms of steel channel headers and miscellaneous framing members as needed to comply with performance requirements.
  3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
  4. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch (1.7 mm).

## 2.7 STAIR RAILINGS AND GUARDRAILS

- A. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
1. Rails and Posts: 1-1/2-inch diameter standard steel pipe top and bottom rails and posts.
  2. Mesh Infill: See drawings for size and pattern of mesh.
  3. Handrails: 1-1/4-inch diameter standard steel pipe.
- B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint as shown in NAAMM AMP 521.
- C. Form changes in direction of railings by bending or by inserting prefabricated elbow fittings.
- D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- E. Close exposed ends of railing members with prefabricated end fittings.
- F. Provide wall returns at ends of wall-mounted handrails.
- G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.

- H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses.

## 2.8 MISCELLANEOUS MATERIALS

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended for interior and exterior applications.

## 2.9 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

## PART 3 - EXECUTION

### 3.1 INSTALLING METAL PAN STAIRS

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- B. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
- C. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints.
- D. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

### 3.2 INSTALLING RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
  - 1. Anchor posts to steel by welding to steel supporting members.
  - 2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.
  - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed ¼ inch in 12 feet.
- B. Attach handrails to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as required to comply with performance requirements.

### 3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

END OF SECTION 055100

## SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Framing with dimension lumber.
  2. Wood blocking and nailers.
  3. Wood furring and grounds.
  4. Plywood backing panels.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
1. Wood-preservative-treated wood.
  2. Power-driven fasteners.
  3. Metal framing anchors.

### PART 2 - PRODUCTS

#### 2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
  2. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less.

#### 2.2 WOOD-PRESERVATIVE-TREATED MATERIAL

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2 for interior construction and Category UC3b for exterior construction.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.



- D. Application: Treat items indicated on Drawings, and the following:
  - 1. Wood, nailers, blocking, stripping, and similar members in connection with flashing.
  - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

## 2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
  - 1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
  - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
  - 1. Plywood backing panels.

## 2.4 DIMENSION LUMBER FRAMING

- A. Framing: No. 2 grade of any of the following species:
  - 1. Hem-fir (north); NLGA.
  - 2. Southern pine; SPIB.
  - 3. Douglas fir-larch; WCLIB or WWPA.
  - 4. Hem-fir; WCLIB or WWPA.

## 2.5 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Furring.
  - 4. Grounds.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.
- C. Concealed Boards: 15 percent maximum moisture content and any of the following species and grades:
  - 1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
  - 2. Eastern softwoods; No. 2 Common grade; NeLMA.
  - 3. Northern species; No. 2 Common grade; NLGA.

4. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

## 2.6 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

## 2.7 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
  1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

## 2.8 METAL FRAMING ANCHORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  1. Cleveland Steel Specialty Co.
  2. KC Metals Products, Inc.
  3. Phoenix Metal Products, Inc.
  4. Simpson Strong-Tie Co., Inc.
  5. USP Structural Connectors.
- B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
  1. Use for interior locations unless otherwise indicated.
- D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.
  1. Use for wood-preservative-treated lumber and where indicated.

## 2.9 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).
- B. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Do not splice structural members between supports unless otherwise indicated.
- D. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- E. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
  - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
  - 3. ICC-ES evaluation report for fastener.

END OF SECTION 061000

## SECTION 061600 - SHEATHING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Wall sheathing.
  - 2. Roof sheathing.
  - 3. Sheathing joint and penetration treatment.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
  - 1. Wood-preserved-treated plywood.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

### PART 2 - PRODUCTS

#### 2.1 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWWPA U1; Use Category UC2 for interior construction.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

#### 2.2 WALL SHEATHING

- A. Plywood Sheathing: DOC PS 1 Exterior, Structural I sheathing.
- B. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Georgia-Pacific Corp.
    - b. National Gypsum Co.; Gold Bond Building Products Division.
    - c. USG Corp.; United States Gypsum Co.
  - 2. Type and Thickness: Regular, 1/2 inch (13 mm).

## 2.3 ROOF SHEATHING

- A. Plywood Sheathing: DOC PS 1 Exposure 1 sheathing, Exterior Sheathing in all exterior applications.
- B. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1 sheathing.

## 2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. For roof, parapet and wall sheathing provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Sheathing to Wood Framing: ASTM C 1002.
- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
  - 1. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C 1002.
  - 2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, use screws that comply with ASTM C 954.

## 2.5 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."
- B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
  - 1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

## 2.6 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
  - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
  - 3. ICC-ES evaluation report for fastener.
- D. Coordinate wall, parapet and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

### 3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
  - 1. Wall and Roof Sheathing:
    - a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
    - b. Screw to cold-formed metal framing.
    - c. Space panels 1/8 inch (3 mm) apart at edges and ends.

### 3.3 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
  - 1. Fasten gypsum sheathing to wood framing with [nails] [or] [screws].
  - 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
  - 3. Install panels with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
  - 4. Install panels with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.
  - 1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.

2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
  1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.
  2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- E. Seal sheathing joints according to sheathing manufacturer's written instructions.
  1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
  2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 061600

## SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Plastic-laminate cabinets.
  - 2. Solid-surface counter-tops and sills.
  - 3. Miscellaneous framing and brackets.
- B. Related Sections include the following:
  - 1. Division 6 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

#### 1.2 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.

#### 1.3 SUBMITTALS

- A. Product Data: For particleboard, plywood, high-pressure decorative laminate, adhesive for bonding plastic laminate, fire-retardant-treated materials, cabinet hardware and accessories, and finishing materials and processes.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
  - 1. Show details full size.
  - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
  - 3. Show locations and sizes of cutouts and holes for plumbing fixtures and other items installed in architectural woodwork.
- C. Samples for each exposed product and for each color and texture specified.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed architectural woodwork similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Fabricator Qualifications: A firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.

#### 1.5 PROJECT CONDITIONS



- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.
  - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## 1.6 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Products: Comply with the following:
  - 1. Hardboard: AHA A135.4.
  - 2. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
  - 3. Softwood Plywood: DOC PS 1, Medium Density Overlay.
  - 4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
  - 5. Trim: Premium grade in accordance with AWI Section 300; maximum moisture content of 6 percent; White Birch, vertical or flat grain, for a transparent finish.
- C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
  - 1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
    - a. As indicated on Drawings.
- D. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
- E. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2
  - 1. Manufacturers: As indicated on Drawings.

### 2.2 PLASTIC-LAMINATE CABINETS

- A. Quality Standard: Comply with AWI Section 400 requirements for laminate cabinets.
- B. Grade: Premium.
- C. AWI Type of Cabinet Construction: Flush overlay.

- D. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
  - 1. Horizontal Surfaces Other Than Tops: HGS.
  - 2. Vertical Surfaces: HGS.
  - 3. Edges: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.
- E. Materials for Semiexposed Surfaces: Provide surface materials indicated below:
  - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.
  - 2. Drawer Sides and Backs: Solid-hardwood lumber.
  - 3. Drawer Bottoms: Hardwood plywood.
- F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. As indicated on Drawings.

### 2.3 CABINET HARDWARE AND ACCESSORIES

- D. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Door Hardware".
- E. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.
- C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing.
  - 1. Provide minimum two hinges per door.
  - 2. Provide minimum three hinges for doors over 36 inches tall.
  - 3. Provide minimum four hinges for doors over 60 inches tall.
- D. Wire Pulls: Back mounted, 4 inches long, 5/16 inches in diameter, polished chrome finish.
- E. Catches: Magnetic catches, BHMA A156.9, B03141.
- F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081 and BHMA A156.9, B04102; with shelf brackets, B04112.
  - 1. 32 MM system is also acceptable.
- G. Shelf Rests: BHMA A156.9, B04013.
- H. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, and rated for the following loads:
  - 1. Box Drawer Slides: 75 lbf.
- I. Door Locks: BHMA A156.11, E07121.
- J. Drawer Locks: BHMA A156.11, E07041.
- K. Grommets for Cable Passage through Countertops: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage. Color to match laminate color.
- L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
  - 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
- M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

### 2.5 SOLID-SURFACING-MATERIAL COUNTERTOPS AND SILLS

- A. Solid-Surfacing-Material Thickness: minimum ½ inch or greater where shown on the

drawings.

- B. Colors, Patterns, and Finishes: As indicated on Drawings.
- C. Fabricate tops in one piece with shop-applied backsplashes. Comply with solid-surfacing-material manufacture's written recommendations for adhesives, sealers, fabrication, and finishing.

## 2.6 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- C. Glue: Aliphatic resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
- D. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer. Do not use adhesives that contain urea formaldehyde.

## 2.7 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide Premium grade interior woodwork complying with the referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
- D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- E. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
  - 1. Seal edges of openings in countertops with a coat of varnish.
- F. Fabricate to AWI premium standards.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.

- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing.

### 3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation.
- E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 96 inches (2400 mm) long except where shorter single-length pieces are necessary.
  - 1. Scarf running joints and stagger in adjacent and related members.
  - 2. Fill gaps, if any, between top of base and wall with [plastic wood filler; sand smooth; and finish same as wood base if finished] [latex sealant, painted to match wall].
  - 3. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
  - 2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
  - 1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
  - 2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
  - 3. Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Touch up finishing work specified in this Section after installation of interior architectural woodwork. Fill nail holes with matching filler where exposed
- D. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

Center For Forensic Psychiatry  
Kitchen  
Michigan Department of Health and Human Services  
Saline, Michigan

File No. 491/20167.SDW  
Index No. 5603  
PSC Project No. 2021094

END OF SECTION 064023

## SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories.
3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
1. Include plans, elevations, sections, and attachment details.
  2. Apply AWI Quality Certification Program label to Shop Drawings.
- C. Samples: For each exposed product and for each color and texture specified.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and Installer.
- B. Research reports.
- C. Field quality control reports.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.
- B. Installer Qualifications: Manufacturer of products.

### PART 2 - PRODUCTS

#### 2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
1. Provide labels and certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.
- B. Architectural Woodwork Standards Grade: Economy.
- C. Type of Construction: Frameless.
- D. Door and Drawer-Front Style: Flush overlay.

1. Reveal Dimension: As indicated.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.
  - a. PLAM-1: Wilsonart LLC., River Cherry 7937-18 (linearity finish- premium grade).
  - b. PLAM-2: Wilsonart LLC., Lisola 5043-15 (fieldstone finish- premium grade)
  - c. PLAM-3: Wilsonart LLC., Natural Cotton 4946-38 (fine velvet finish- premium grade)
- F. Laminate Cladding for Exposed Surfaces:
  1. Horizontal Surfaces: Grade HGS.
  2. Postformed Surfaces: Grade HGP.
  3. Vertical Surfaces: Grade HGS.
  4. Edges: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
  5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels [As indicated].
- G. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
  1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  1. As selected by Architect from laminate manufacturer's full range.

## 2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
  1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
  1. Particleboard (Medium Density): ANSI A208.1, Grade M-2.
  2. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10 that will be concealed from view after installation.

## 2.3 CABINET HARDWARE AND ACCESSORIES

- A. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 100 degrees of opening, self-closing.
- B. Wire Pulls: Back mounted, solid metal, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.
- C. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; with shelf rests, B04081.
- D. Shelf Rests: ANSI/BHMA A156.9, B04013; two-pin plastic with shelf hold-down clip.
- E. Drawer Slides: ANSI/BHMA A156.9.
  1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer.
    - a. Type: Full extension.

- b. Material: Zinc-plated steel with polymer rollers.
- 2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
- 3. For drawers not more than 3 inches (75 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1.
- 4. For drawers more than 3 inches (75 mm) high, but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1.
- 5. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-100.
- F. Door Locks: ANSI/BHMA A156.11, E07121.
- G. Drawer Locks: ANSI/BHMA A156.11, E07041.
- H. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.
- I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
  - 1. Satin Stainless Steel: ANSI/BHMA 630.
- J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

#### 2.4 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
  - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

#### 2.5 FABRICATION

- A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.
- B. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.



- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) using concealed shims.
  - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
  - 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch (38-mm) penetration into wood framing, blocking, or hanging strips.

### 3.2 FIELD QUALITY CONTROL

- A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
  - 1. Inspection entity shall prepare and submit report of inspection.

END OF SECTION 064116

## SECTION 071113 - BITUMINOUS DAMPPROOFING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Cold-applied, emulsified-asphalt dampproofing to be installed on the exterior face of inner wythe of exterior masonry cavity walls.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise indicated.

#### 2.2 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Approved products:
  - 1. Sonneborn Hydrocide Semi-Mastic 700B
  - 2. W.R. Meadows Sealmastic Semi-Mastic
- B. Trowel Coats: ASTM D1227, Type II, Class 1.
- C. Fibered Brush and Spray Coats: ASTM D1227, Type II, Class 1.
- D. Brush and Spray Coats: ASTM D1227, Type III, Class 1.

#### 2.3 AUXILIARY MATERIALS

- A. Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- B. Emulsified-Asphalt Primer: ASTM D1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.
- C. Asphalt-Coated Glass Fabric: ASTM D1668/D1668M, Type I.

### PART 3 - EXECUTION

#### 3.1 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless otherwise indicated.
  - 1. Apply dampproofing to provide continuous plane of protection.
  - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
  
- B. Where dampproofing exterior face of inner wythe of exterior masonry cavity walls, lap dampproofing at least **1/4 inch (6 mm)** onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.
  - 1. Extend dampproofing over outer face of structural members and concrete slabs that interrupt inner wythe.
  - 2. Lap dampproofing at least **1/4 inch (6 mm)** onto shelf angles supporting veneer.

#### 3.2 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Exterior Face of Inner Wythe of Cavity Walls: Apply primer and one brush or spray coat at not less than **1 gal./100 sq. ft. (0.4 L/sq. m)**.

END OF SECTION 071113

## SECTION 071416 - COLD FLUID-APPLIED WATERPROOFING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Polyurethane waterproofing to be installed over existing concrete foundation wall as indicated on drawings.

#### 1.2 PREINSTALLATION MEETINGS

- ##### A. Preinstallation Conference: Conduct conference at Project site.

#### 1.3 ACTION SUBMITTALS

- ##### A. Product Data: For each type of product.
- ##### B. Shop Drawings:

1. Show locations and extent of waterproofing.
2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

#### 1.4 INFORMATIONAL SUBMITTALS

- ##### A. Sample warranty.

#### 1.5 QUALITY ASSURANCE

- ##### A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

#### 1.6 WARRANTY

- ##### A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace waterproofing that fails in materials or workmanship within specified warranty period.
1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 SINGLE-COMPONENT POLYURETHANE WATERPROOFING

- A. Single-Component, Modified Polyurethane Waterproofing: ASTM C836/C836M and coal-tar free.
  - 1. Basis of design: Tremco Tremproof 201/60.

### 2.2 AUXILIARY MATERIALS

- A. Primer: Manufacturer's standard primer, sealer, or surface conditioner; factory-formulated.
- B. Sheet Flashing: 50-mil- (1.3-mm-) minimum, nonstaining, uncured sheet neoprene.
  - 1. Adhesive: Manufacturer's recommended contact adhesive.
- C. Membrane-Reinforcing Fabric: Manufacturer's recommended fiberglass mesh or polyester fabric.
- D. Joint Reinforcing Strip: Manufacturer's recommended fiberglass mesh or polyester fabric.
- E. Joint Sealant: Multicomponent polyurethane sealant, compatible with waterproofing; and as recommended by manufacturer for substrate and joint conditions.
  - 1. Backer Rod: Closed-cell polyethylene foam.

### 2.3 PROTECTION COURSE

- A. Protection Course: ASTM D6506, semirigid sheets of fiberglass- or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
  - 1. Thickness: 1/8 inch (3 mm), nominal.
  - 2. Adhesive: Rubber-based solvent type recommended in writing by waterproofing manufacturer.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.

- D. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.
- E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.
- F. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners according to waterproofing manufacturer's written instructions and to recommendations in ASTM C898/C898M and ASTM C1471/C1471M.
- G. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.
- H. Prepare, treat, rout, and fill joints and cracks in substrate according to waterproofing manufacturer's written instructions and to recommendations in ASTM C898/C898M and ASTM C1471/C1471M. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D4258.
- I. Install sheet flashing and bond to deck and wall substrates where required according to waterproofing manufacturer's written instructions.

### 3.2 WATERPROOFING APPLICATION

- A. Apply waterproofing according to manufacturer's written instructions and to recommendations in ASTM C898/C898M and ASTM C1471/C1471M.
- B. Reinforced Waterproofing Applications.
  - 1. Apply first coat of waterproofing, embed membrane-reinforcing fabric, and apply second coat of waterproofing to completely saturate reinforcing fabric and to obtain a seamless reinforced membrane free of entrapped gases and pinholes, with an average dry film total thickness of **80 mils (2 mm)**.
- C. Install protection course with butted joints over waterproofing before starting subsequent construction operations.
  - 1. For vertical applications, set protection course in nominally cured membrane, which will act as an adhesive. If membrane cures before application of protection course, use adhesive.

### 3.3 PROTECTION

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

END OF SECTION 071416

## SECTION 072100 - THERMAL INSULATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Extruded polystyrene foam-plastic board.
  2. Glass-fiber blanket.
  3. Glass-fiber board.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Research reports.

### PART 2 - PRODUCTS

#### 2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

- A. Extruded polystyrene boards in this article are also called "XPS boards."
- B. Extruded Polystyrene Board, Type VI: ASTM C 578, Type VI, 40-psi (276-kPa) minimum compressive strength; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dow Chemical Company (The).
    - b. Owens Corning.

#### 2.2 GLASS-FIBER BLANKET

- A. Glass-Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Knauf Insulation; EcoBatt Unfaced with ECOSE Technology or a comparable product by one of the following:

- a. CertainTeed Corporation.
- b. Johns Manville; a Berkshire Hathaway company.
- c. Owens Corning.

## 2.3 GLASS-FIBER BOARD

- A. Glass-Fiber Board, Unfaced: ASTM C 612, Type IA; unfaced, with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84, passing ASTM E 136 for combustion characteristics. Nominal density of 2.25 lb/cu. ft. (36 kg/cu. m), thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C).
  1. Basis-of-Design Product: Subject to compliance with requirements, provide Knauf Insulation ; Earthwool Insulation Board with ECOSE Technology. or a comparable product by one of the following:
    - a. CertainTeed Corporation.
    - b. Johns Manville; a Berkshire Hathaway company.
    - c. Owens Corning.

## 2.4 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
  1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
- B. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.
- C. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
  1. Adhesives shall have a VOC content of 70 g/L or less.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.



- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

### 3.2 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
  - 1. If not otherwise indicated, extend insulation a minimum of 36 inches (915 mm) below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
  - 1. If not otherwise indicated, extend insulation a minimum of 36 inches (915 mm) in from exterior walls.

### 3.3 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors.
- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

### 3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
  - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
  - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
  - 4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

### 3.5 INSTALLATION OF CURTAIN-WALL INSULATION

- A. Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.
  1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
  2. Install insulation to fit snugly without bowing.

END OF SECTION 072100

## SECTION 072600 - VAPOR RETARDERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Polyethylene vapor retarders.
- B. Related Requirements:
  - 1. Section 092900 "Gypsum Board" for vapor retarders.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.

### PART 2 - PRODUCTS

#### 2.1 POLYETHYLENE VAPOR RETARDERS

- A. Polyethylene Vapor Retarders:  
Basis of Design: spunbonded polyolefin, non-woven, non-perforated, weather barrier is based upon DuPont™ Tyvek® CommercialWrap® and related assembly components.

##### Performance Characteristics:

1. Air Penetration: 0.001 cfm/ft<sup>2</sup> at 75 Pa, when tested in accordance with ASTM E2178. Type I per ASTM E1677. ≤0.04 cfm/ft<sup>2</sup> at 75 Pa, when tested in accordance with ASTM E2357
2. Water Vapor Transmission: 28 perms, when tested in accordance with ASTM E96, Method B.
3. Water Penetration Resistance: 280 cm when tested in accordance with AATCC Test Method 127.
4. Basis Weight: 2.7 oz/yd<sup>2</sup>, when tested in accordance with TAPPI Test Method T-410.
5. Air Resistance: Air infiltration at >1500 seconds, when tested in accordance with TAPPI Test Method T-460.
6. Tensile Strength: 38/35 lbs/in., when tested in accordance with ASTM D882, Method A.
7. Tear Resistance: 12/10 lbs., when tested in accordance with ASTM D1117.
8. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E 84. Flame Spread: 10, Smoke Developed: 10

### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF VAPOR RETARDERS ON FRAMING

- A. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.
- C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

END OF SECTION 072600

## SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Adhered ethylene-propylene-diene-monomer (EPDM) roofing system.
  - 2. Roof Insulation
  - 3. Cover Board

#### 1.2 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Roofing Conference: Conduct conference at Project site.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Verification: For each product included in membrane roofing system.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Research/Evaluation Reports: For components of roofing system, from ICC-ES.
- B. Sample Warranties: For manufacturer's special warranties.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

#### 1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 20 years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain components including roof insulation and fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
- B. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.
- C. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

## 2.3 EPDM ROOFING

- A. EPDM: ASTM D 4637, Type II, internally reinforced, uniform, flexible EPDM sheet.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Firestone Building Products.
    - b. Carlisle SynTec Incorporated.
    - c. Johns Manville; a Berkshire Hathaway company.
  - 2. Thickness: 60 mils (1.5 mm), nominal.
  - 3. Exposed Face Color: Black.

## 2.4 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
- B. Sheet Flashing: 60-mil- (1.5-mm-) thick EPDM, partially cured or cured, according to application.
- C. Bonding Adhesive: Manufacturer's standard.
- D. Seaming Material: Single-component, butyl splicing adhesive and splice cleaner or Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- (75-mm-) wide minimum, butyl splice tape with release film.
- E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.
- F. Miscellaneous Accessories: Provide lap sealant, water cutoff mastic, metal termination bars, metal battens, pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

## 2.5 ROOF INSULATION

- A. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces.
- B. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.
- C. Cover Board: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch thick.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

## 2.6 INSULATION ACCESSORIES

- A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- C. Roofing Asphalt: ASTM D 312, Type III or Type IV.
  - 1. Asphalt Primer: ASTM D 41/D 41M.

## PART 3 - EXECUTION

### 3.1 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions.
- B. Complete terminations and base flashings **BASED ON 20 YEAR WARRANTED DETAILS** and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roofing and auxiliary materials to tie into existing roofing to maintain weather tightness of transition and to not void warranty for existing roofing system.

### 3.2 INSULATION INSTALLATION

- A. Coordinate installing roofing system components, so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Install tapered insulation under area of roofing to conform to slopes indicated.
- C. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness of 3 inches (68 mm) or greater to meet R value required, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
- D. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
  - 1. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

### 3.3 INSTALLATION OF COVER BOARDS

- A. Install cover boards with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction.
  - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
  - 2. At internal roof drains, conform to slope of drain sump.
    - a. Trim cover board so that water flow is unrestricted.
  - 3. Cut and fit cover board tight to nailers, projections, and penetrations.
  - 4. Loosely lay cover board over substrate.
  - 5. Mechanically fasten to existing substrate using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:

### 3.4 ADHERED ROOFING INSTALLATION

- A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll membrane roof membrane and allow to relax before installing.
- C. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.
- E. Roofing Asphalt: Apply a solid mopping of roofing asphalt to substrate at temperature and rate required by manufacturer, and install fabric-backed roofing. Do not apply to splice area of roof membrane.
- F. Fabric-Backed Roof Membrane Adhesive: Apply to substrate at rate required by manufacturer, and install fabric-backed roof membrane.
- G. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeters.
- H. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- I. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement.
  - 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
  - 2. Apply lap sealant and seal exposed edges of roofing terminations.
  - 3. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.
- J. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape.
  - 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
  - 2. Apply lap sealant and seal exposed edges of roofing terminations.
- K. Factory-Applied Seam Tape Installation: Clean and prime surface to receive tape.
  - 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
  - 2. Apply lap sealant and seal exposed edges of roofing terminations.
- L. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.
- M. Adhere protection sheet over roof membrane at locations indicated.

### 3.5 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.



3.6 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

PART 4 - INSTALLER'S WARRANTY

4.1 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS \_\_\_\_\_ of \_\_\_\_\_, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
  - 1. Owner: \_\_\_\_\_.
  - 2. Address: \_\_\_\_\_.
  - 3. Building Name/Type: \_\_\_\_\_.
  - 4. Address: \_\_\_\_\_.
  - 5. Area of Work: \_\_\_\_\_.
  - 6. Acceptance Date: \_\_\_\_\_.
  - 7. Warranty Period: \_\_\_\_\_.
  - 8. Expiration Date: \_\_\_\_\_.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
  - 1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
    - a. lightning;
    - b. peak gust wind speed exceeding \_\_\_\_\_ mph;
    - c. fire;
    - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    - f. vapor condensation on bottom of roofing; and
    - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
  - 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and

- expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
  4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
  5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
  6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
  7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.
- E. IN WITNESS THEREOF, this instrument has been duly executed this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.
1. Authorized Signature: \_\_\_\_\_.
  2. Name: \_\_\_\_\_.
  3. Title: \_\_\_\_\_.

END OF SECTION 075323

## SECTION 076200 - SHEET METAL FLASHING AND TRIM

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Formed wall sheet metal fabrications.

#### 1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

- C. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.

- D. Samples: For each exposed product and for each color and texture specified.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product certificates.

- B. Product test reports.

- C. Sample warranty.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

## 1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
  - 1. For copings and roof edge flashings that are SPRI ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.
- B. Mockups: Build mockups to verify selections made under Sample submittals to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

## 1.7 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Finish Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

### 2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; 2B (bright, cold rolled) finish.

## 2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Carlisle Coatings & Waterproofing Inc.
    - b. Carlisle Residential; a division of Carlisle Construction Materials.
    - c. Grace Construction Products; W.R. Grace & Co. -- Conn.
    - d. Henry Company.
  2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C) or higher.
  3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C) or lower.

## 2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
    - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
    - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
    - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
  2. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- G. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## 2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
  - 1. Obtain field measurements for accurate fit before shop fabrication.
  - 2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
  - 3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
  - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
  - 2. Use lapped expansion joints only where indicated on Drawings.
- C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- D. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- E. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

## 2.6 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond

each side of wall openings; and form with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:

1. Stainless Steel: 0.016 inch (0.40 mm) thick.
- B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:
1. Stainless Steel: 0.016 inch (0.40 mm) thick.

### PART 3 - EXECUTION

#### 3.1 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.

#### 3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
  2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
  3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
  4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
  5. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
  1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
  2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

### 3.3 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 042000 "Unit Masonry." Section 044200 "Exterior Stone Cladding."
- C. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

### 3.4 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.



Center For Forensic Psychiatry  
Kitchen  
Michigan Department of Health and Human Services  
Saline, Michigan

File No. 491/20167.SDW  
Index No. 5603  
PSC Project No. 2021094

END OF SECTION 076200

## SECTION 077100 - ROOF SPECIALTIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Copings.
  - 2. Roof-edge specialties.
  - 3. Reglets and counterflashings.
- B. Preinstallation Conference: Conduct conference at Project site.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
  - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- C. Shop Drawings: For roof specialties.
  - 1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
- D. Samples: For each type of roof specialty and for each color and texture specified.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For tests performed by a qualified testing agency.
- B. Sample warranty.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing specialties to include in maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class and SPRI ES-1 tested to specified design pressure.

## 1.6 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- B. Anodized finishes do not require a finish warranty
  - 1.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. FM Approvals' Listing: Manufacture and install roof-edge specialties that are listed in FM Approvals' "RoofNav" and approved for windstorm classification. Identify materials with FM Approvals' markings.
- B. SPRI Wind Design Standard: Manufacture and install roof-edge specialties tested according to SPRI ES-1 and capable of resisting the following design pressures:
  - 1. Design Pressure: As indicated on Drawings.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

### 2.2 ROOF-EDGE SPECIALTIES

- A. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet (3.6 m) and a continuous metal receiver with integral drip-edge cleat to engage fascia cover and secure single-ply roof membrane. Provide matching corner units.
  - 1. Basis of Design- Basis of Design- 'OMG Roofing Products'- 'Terminedge Ex' Facia with Extruded retainer, or approved comparable product by one of the following:
    - a. Hickman Company, W. P.
    - b. Metal-Era, Inc.
  - 2. Formed Aluminum Sheet Fascia Covers: Aluminum sheet, 0.063 inch (1.60 mm) thick.

- a. Surface: Smooth, flat finish.
- b. Finish: Color anodic.
- c. Color: Dark bronze.
3. Corners: Factory mitered and mechanically clinched and sealed watertight.
4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
5. Receiver: Aluminum sheet, 0.050 inch (1.27 mm) thick.
6. Fascia Accessories: Spillover scuppers.

## 2.3 REGLETS AND COUNTERFLASHINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Cheney Flashing Company.
  2. Fry Reglet Corporation.
  3. Heckmann Building Products, Inc.
  4. Hickman Company, W. P.
  5. Metal-Era, Inc.
- B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
  1. Formed Aluminum: 0.040 inch Insert value thick.
  2. Stainless Steel: .020 inch thick.
  3. Corners: Factory mitered and continuously welded.
  4. Stucco Type, Embedded: Provide reglets with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
  5. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.
- C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches (100 mm) and in lengths not exceeding 12 feet (3.6 m) designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:
  1. Stainless Steel: 0.20 inch thick.
- D. Accessories:
  1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
  2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
- E. Stainless-Steel Finish: No. 2B (bright, cold rolled, unpolished).

## 2.4 MATERIALS

- A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
- B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

## 2.5 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
  - 1. Thermal Stability: ASTM D 1970/D 1970M; stable after testing at 240 deg F (116 deg C).
  - 2. Low-Temperature Flexibility: ASTM D 1970/D 1970M; passes after testing at minus 20 deg F (29 deg C).
- B. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- C. Slip Sheet: Rosin-sized building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum.

## 2.6 MISCELLANEOUS MATERIALS

- A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
  - 1. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
  - 2. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- B. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- C. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- E. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## 2.7 FINISHES

- A. Coil-Coated Aluminum Sheet Finishes:
  - 1. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

## PART 3 - EXECUTION

### 3.1 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.
  - 1. Apply continuously under roof-edge specialties and reglets and counterflashings.
  - 2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.
- B. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).
- C. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

### 3.2 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
  - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
  - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
  - 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
  - 4. Torch cutting of roof specialties is not permitted.
  - 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
  - 1. Coat concealed side of uncoated aluminum and stainless-steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
  - 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise indicated on Drawings.
  2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
- E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

### 3.3 ROOF-EDGE SPECIALITIES INSTALLATION

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

### 3.4 REGLET AND COUNTERFLASHING INSTALLATION

- A. Embedded Reglets: See Section 042000 "Unit Masonry" for installation of reglets.
- B. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches (100 mm) over top edge of base flashings.
- C. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches (100 mm) over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with butyl sealant. Fit counterflashings tightly to base flashings.

### 3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed.

END OF SECTION 077100

## SECTION 078413 - PENETRATION FIRESTOPPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

#### 1.2 PREINSTALLATION MEETINGS

- ##### A. Preinstallation Conference: Conduct conference at Project site.

#### 1.3 ACTION SUBMITTALS

- ##### A. Product Data: For each type of product.

##### B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

- ##### C. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

#### 1.4 INFORMATIONAL SUBMITTALS

- ##### A. Product test reports.

#### 1.5 CLOSEOUT SUBMITTALS

- ##### A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.



## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

## PART 2 - PRODUCTS

### 2.1 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. 3M Fire Protection Products.
    - b. A/D Fire Protection Systems Inc.
    - c. Construction Solutions.
    - d. Grabber Construction Products.
    - e. Hilti, Inc.
    - f. HOLDRITE.
    - g. NUCO Inc.
    - h. Passive Fire Protection Partners.
    - i. RectorSeal.
    - j. Specified Technologies, Inc.
    - k. Tremco, Inc.
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
  2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
  3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
- D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.
  1. Sealant shall have a VOC content of 250 g/L or less.
- F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
  1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- D. Install fill materials by proven techniques to produce the following results:
  1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
  2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
  3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.2 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
  1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
  2. Contractor's name, address, and phone number.
  3. Designation of applicable testing and inspecting agency.
  4. Date of installation.
  5. Manufacturer's name.
  6. Installer's name.

### 3.3 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.
- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

### 3.4 PENETRATION FIRESTOP SYSTEM SCHEDULE

- A. Firestop Systems with No Penetrating Items:
  1. Type of Fill Materials: One or more of the following:
    - a. Latex sealant.
    - b. Silicone sealant.
    - c. Intumescent putty.
    - d. Mortar.
- B. Firestop Systems for Metallic Pipes, Conduit, or Tubing:
  1. Type of Fill Materials: One or more of the following:
    - a. Latex sealant.
    - b. Silicone sealant.
    - c. Intumescent putty.
    - d. Mortar.

C. Firestop Systems for Nonmetallic Pipe, Conduit, or Tubing:

1. Type of Fill Materials: One or more of the following:
  - a. Latex sealant.
  - b. Silicone sealant.
  - c. Intumescent putty.
  - d. Intumescent wrap strips.
  - e. Firestop device.

D. Firestop Systems for Electrical Cables:

1. Type of Fill Materials: One or more of the following:
  - a. Latex sealant.
  - b. Silicone sealant.
  - c. Intumescent putty.
  - d. Silicone foam.
  - e. Pillows/bags.

E. Firestop Systems for Cable Trays:

1. Type of Fill Materials: One or more of the following:
  - a. Latex sealant.
  - b. Intumescent putty.
  - c. Silicone foam.
  - d. Pillows/bags.
  - e. Mortar.

F. Firestop Systems for Insulated Pipes:

1. Type of Fill Materials: One or more of the following:
  - a. Latex sealant.
  - b. Intumescent putty.
  - c. Silicone foam.
  - d. Intumescent wrap strips.

G. Firestop Systems for Miscellaneous Electrical Penetrants:

1. Type of Fill Materials: One or more of the following:
  - a. Latex sealant.
  - b. Intumescent putty.
  - c. Mortar.

H. Firestop Systems for Miscellaneous Mechanical Penetrants:

1. Type of Fill Materials: One or both of the following:
  - a. Latex sealant.

- b. Mortar.
- I. Firestop Systems for Groupings of Penetrants:
  - 1. Type of Fill Materials: One or more of the following:
    - a. Latex sealant.
    - b. Mortar.
    - c. Intumescent wrap strips.
    - d. Firestop device.
    - e. Intumescent composite sheet.

END OF SECTION 078413

## SECTION 079200 - JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Silicone joint sealants.
  - 2. Urethane joint sealants.
  - 3. Latex joint sealants.

#### 1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Sustainable Design Submittals:
  - 1. Product Data: For sealants, indicating VOC content.
  - 2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
- C. Samples: For each kind and color of joint sealant required.
- D. Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.
  - 3. Joint-sealant formulation.
  - 4. Joint-sealant color.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Preconstruction laboratory test reports.
- C. Preconstruction field-adhesion-test reports.
- D. Field-adhesion-test reports.

- E. Sample warranties.

## 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

## 1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Stain Testing: Use ASTM C 1248 to determine stain potential of sealant when in contact with stone and masonry substrates.

- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

## 1.7 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period for Horizontal Applications: 5 years from date of Substantial Completion.
2. Warranty Period for Vertical Applications: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 JOINT SEALANTS, GENERAL

- A. VOC Content: Sealants and sealant primers shall comply with the following:

1. Architectural sealants shall have a VOC content of 250 g/L or less.
  2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
  3. Sealants and sealant primers for porous substrates shall have a VOC content of 775 g/L or less.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.
- C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

## 2.2 SILICONE JOINT SEALANTS

- A. Mildew-Resistant, Acid-Curing Silicone Joint Sealant SS-1: ASTM C 920.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dow Corning Corporation.
    - b. GE Advanced Materials - Silicones.
    - c. Tremco Incorporated.
    - d. Sika Corporation: SikaSil GP
  2. Type: Single component (S).
  3. Grade: nonsag (NS).
  4. Class: 25.
  5. Uses Related to Exposure: Nontraffic (NT).
- B. Neutral-Curing Silicone Joint Sealant SS-2: ASTM C 920.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dow Corning Corporation; 795.
    - b. GE Silicones; Silglaze II SCS2800.
    - c. Tremco; Spectrem 2.
    - d. Pecora Corporation; Pecora 895
    - e. Sika Corporation; SikaSil WS 295
  2. Type: Single component (S).
  3. Grade: nonsag (NS).
  4. Class: 25.
  5. Uses Related to Exposure: Nontraffic (NT).



## 2.3 URETHANE JOINT SEALANTS

### A. Urethane Joint Sealant US-1: ASTM C 920.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Pecora Corporation; Urexpan NR-201.
  - b. Polymeric Systems Inc.; Flexiprene 952.
  - c. Tremco; Tremflex S/L.
  - d. Tremco; Vulkem 45.
  - e. Sonneborn Building Products, Div., BASF; SL 1.
  - f. Sika Corporation; Sikaflex 1CSL
2. Type: Single component (S).
3. Grade: Pourable (P).
4. Class: 25.
5. Uses Related to Exposure: Traffic (T) and Nontraffic (NT).

## 2.4 LATEX JOINT SEALANTS

### A. Latex Joint Sealant LS-1: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NS.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Pecora Corporation.
  - b. Sonneborn, Division of BASF.; Sonolac.
  - c. Tremco Incorporated.

## 2.5 JOINT SEALANT BACKING

- A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

## 2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove laitance and form-release agents from concrete.
  - 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

#### 3.2 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with ASTM C 1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 1. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

### 3.3 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
  - 1. Extent of Testing: Test completed and cured sealant joints as follows:
    - a. Perform 3 tests for the first 300 feet of joint length for each kind of sealant and joint substrate.
    - b. Perform one test for each 300 feet of joint length thereafter or one test per each floor per elevation.
  - 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

### 3.4 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces US-1.
  - 1. Joint Locations:
    - a. Isolation and contraction joints in cast-in-place concrete slabs.
  - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces SS-2.
  - 1. Joint Locations:
    - a. Control and expansion joints in unit masonry.
    - b. Joints in glass unit masonry assemblies.
    - c. Joints between metal panels.
    - d. Perimeter joints between materials listed above and frames of doors windows and louvers.
    - e. Control and expansion joints in ceilings and other overhead surfaces.
  - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces US-1.
  - 1. Joint Locations:
    - a. Isolation joints in cast-in-place concrete slabs.
    - b. Control and expansion joints in tile flooring.

2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces SS-2 or LS-1.
1. Joint Locations:
    - a. Control and expansion joints on exposed interior surfaces of exterior walls.
    - b. Perimeter joints of exterior openings where indicated.
    - c. Vertical joints on exposed surfaces of interior unit masonry and partitions.
    - d. Joints on underside of plant-precast structural concrete beams and planks.
    - e. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces SS-1.
1. Joint Sealant Location:
    - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - b. Tile control and expansion joints in toilet rooms.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

## SECTION 079513.13 - INTERIOR EXPANSION JOINT COVER ASSEMBLIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes interior expansion joint cover assemblies.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each expansion joint cover assembly.
- C. Samples: For each expansion joint cover assembly and for each color and texture specified.

### PART 2 - PRODUCTS

#### 2.1 ASSEMBLY DESCRIPTION

- A. Furnish units in longest practicable lengths to minimize field splicing.
- B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

#### 2.2 PERFORMANCE REQUIREMENTS

- A. Expansion Joint Design Criteria:
  - 1. Type of Movement: Thermal.
    - a. Nominal Joint Width: 2 inches (at New Addition to Existing).

#### 2.3 WALL EXPANSION JOINT COVERS

- A. Metal-Plate Wall Joint Cover: Metal cover plate fixed on one side of joint gap and free to slide on other.
  - 1. Basis-of Design Product: Subject to compliance with requirements, provide Balco, Inc. # 6TWC-1-2 and 6TW-1-2 at walls and 75FCA-1 and 75FCACS-1 at ceilings and corresponding floor expansion joints or comparable products by the following approved manufacturers:
    - a. Architectural Art Manufacturing, Inc.
    - b. C/S Group
    - c. InPro Corporation (IPC)
    - d. MM Systems Corporation
    - e. Nystorm, Inc.
    - f. Waston Bowman Acme Corp.
  - 2. Application: Wall to corner.
  - 3. Exposed Metal:
    - a. Aluminum: Clear anodic, Class I
  - 4. Provide Balco, Inc. #MBW2H0350 Fire Barrier System behind the metal plate wall cover where a fire rated assembly is shown.

## 2.4 MATERIALS

- A. Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), Alloy 6061-T6 for sheet and plate.
- B. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.

## 2.5 ALUMINUM FINISHES

- A. Mill finish.
- B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

## 2.6 ACCESSORIES

- A. Manufacturer's standard attachment devices, as indicated or required for complete installations.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.
- B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies.
- C. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.
- D. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.
  - 1. Repair or grout block out as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
  - 2. Install frames in continuous contact with adjacent surfaces.
    - a. Shimming is not permitted.
  - 3. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
  - 4. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
  - 5. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
  - 6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.
- E. Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
  - 1. Provide in continuous lengths for straight sections.
  - 2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
  - 3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- F. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

- G. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

### 3.2 PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete.
- B. Protect the installation from damage by work of other Sections.

END OF SECTION 079513.13

## SECTION 079513.16 - EXTERIOR EXPANSION JOINT COVER ASSEMBLIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes exterior building expansion joint cover assemblies for masonry walls.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each expansion joint cover assembly.
- C. Samples for Architect's Selection: For each exposed material showing the full range of colors and finishes available.

### PART 2 - PRODUCTS

#### 2.1 ASSEMBLY DESCRIPTION

- A. Furnish units in longest practicable lengths to minimize field splicing.
- B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

#### 2.2 PERFORMANCE REQUIREMENTS

- A. Expansion Joint Design Criteria:
  - 1. Type of Movement: Thermal.
    - a. Nominal Joint Width: 2 inches (at New Addition to Existing).

#### 2.3 EXTERIOR EXPANSION JOINT COVERS

- A. Exterior Elastomeric-Seal Joint Cover: Assembly consisting of elastomeric seal anchored to surface-mounted frames fixed to sides of joint gap.
  - 1. Basis-of Design Product: Subject to compliance with requirements, provide Balco, Inc. # FCVSE-2-San and FCVS-2-San Series or comparable products by the following approved manufacturers:
    - a. Architectural Art Manufacturing, Inc.
    - b. C/S Group
    - c. InPro Corporation (IPC)
    - d. MM Systems Corporation
    - e. Nystorm, Inc.
    - f. Waston Bowman Acme Corp.
  - 2. Application: Wall to wall.
  - 3. Installation: Recessed.
  - 4. Exposed Metal:
    - a. Aluminum: Clear anodic, Class I.
  - 5. Seal: Preformed elastomeric membrane or extrusion.
    - a. Color: As selected by Architect from manufacturer's full range.



#### 2.4 MATERIALS

- A. Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), Alloy 6061-T6 for sheet and plate.
- B. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.
- C. Moisture Barrier: Manufacturer's standard, flexible elastomeric material.

#### 2.5 ALUMINUM FINISHES

- A. Mill finish.
- B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

#### 2.6 ACCESSORIES

- A. Moisture Barriers: Manufacturer's standard moisture barrier consisting of a continuous, waterproof membrane within joint and attached to substrate on sides of joint.
- B. Manufacturer's standard attachment devices, as indicated or required for complete installations.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.
- B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.
- C. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.
- D. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.
  - 1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
  - 2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
  - 3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
  - 4. Install frames in continuous contact with adjacent surfaces.
    - a. Shimming is not permitted.
  - 5. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.
- E. Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
  - 1. Provide in continuous lengths for straight sections.
  - 2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
  - 3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

- F. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

### 3.2 PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- B. Protect the installation from damage by work of other Sections.

END OF SECTION 079513.16

## SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes hollow metal doors and frames.
- B. All hardware for the hollow metal doors is specified in Section 087100-Door Hardware.

#### 1.2 SUBMITTALS

- A. Product Data: For each product indicated. Include door designation, type, level and model, material description, label compliance, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.
- C. Door Schedule. Use same reference designations indicated on Drawings.

#### 1.3 QUALITY ASSURANCE

- A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.
- C. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Amweld International, LLC.
  - 2. Ceco Door Products; an Assa Abloy Group Company.
  - 3. Curries Company; an Assa Abloy Group Company.
  - 4. Mesker Door, Inc.
  - 5. Pioneer Industries Inc.
  - 6. Republic Doors and Frames.
  - 7. Steelcraft; an Ingersoll-Rand Company.

#### 2.2 MATERIALS

- A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.
- C. Metallic-Coated Steel Sheets: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with an A40 (ZF120) zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.

## 2.3 DOORS

- A. Interior Doors: Complying with ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level indicated.
  - 1. Interior Doors (Extra-Heavy-Duty Doors) Level 3 and Physical Performance Level A, Model 1 (Full Flush) 0.053-inch-thick (16 gage).

## 2.4 FRAMES

- A. General: ANSI A250.8; conceal fastenings, unless otherwise indicated.
- B. Frame Steel Sheet Thickness:
  - 1. Interior Frames of minimum 0.053-inch-thick (16 gage) for level 3 steel doors and wood doors.
- C. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
- D. Construction: Full profile welded.
- E. Door Silencers: Three silencers on single-door frames and two silencers on double-door frames.
- F. Jamb Anchors:
  - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
  - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
- G. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Zinc-coat items that are to be built into exterior walls according to ASTM A 153/A 153M, Class C or D as applicable.
- H. Grout: Where required in masonry construction, as specified in Division 4 "Unit Masonry."

## 2.5 FABRICATION

- A. General: Fabricate steel door and frame units to comply with ANSI A250.8 free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant.
- B. Interior Door and Panel Faces: Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from cold-rolled steel sheet.
- C. Core Construction: Manufacturer's standard core construction that produces a door complying with SDI standards.
- D. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch (3.2 mm) at jambs and heads, except not more than 1/4 inch (6.4 mm) between pairs of doors. Not more than 3/4 inch (19 mm) at bottom.
- E. Clearances for Fire-Rated Doors: As required by NFPA 80.
- F. Door-Edge Profile: Square edge, unless beveled edge is indicated.
- G. Tolerances: Comply with SDI 117.
- H. Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.
- I. Frame Construction:
  - 1. Fabricate frames with mitered or coped and continuously welded corners and seamless face joints. Provide temporary spreader bars.
  - 2. Provide terminated stops, where indicated.

- J. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
- K. Locate hardware as indicated or, if not indicated, according to ANSI A250.8.
- L. Glazing Stops: Manufacturer's standard, formed from 0.032-inch- (0.8-mm-) thick steel sheet.
  - 1. Provide nonremovable stops on secure side of interior doors for glass, louvers, and other panels in doors.
  - 2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.
- M. Astragals: As required by NFPA 80 to provide fire ratings indicated.

## 2.6 FINISHES

- A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.
- B. Interior Doors Color: Color shall match existing interior light brown.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
  - 1. Wall Anchors: Provide at least three anchors per jamb. For openings 90 inches (2286 mm) or more in height, install an additional anchor at hinge and strike jambs.
  - 2. Fire-Rated Frames: Install according to NFPA 80.
- B. Door Installation: Comply with ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.
  - 1. Fire-Rated Doors: Install within clearances specified in NFPA 80.
  - 2. Smoke Control Doors: Install to comply with NFPA 105.
- C. Prime Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
- D. After installation, remove protective wrappings from doors and frames and touch up prime coat with compatible air-drying primer.

END OF SECTION 081113

## SECTION 081416 - FLUSH WOOD DOORS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.

##### B. Related Requirements:

1. Section 088000 "Glazing" for glass view panels in flush wood doors.

#### 1.2 ACTION SUBMITTALS

##### A. Product Data: For each type of door. Include factory-finishing specifications.

##### B. Sustainable Design Submittals:

1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
3. Chain-of-Custody Qualification Data: For manufacturer and vendor.
4. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
5. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
6. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
7. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.

##### C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Requirements for veneer matching.
6. Doors to be factory finished and finish requirements.

7. Fire-protection ratings for fire-rated doors.

D. Samples: For factory-finished doors.

### 1.3 INFORMATIONAL SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

### 1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Algoma Hardwoods, Inc.
2. Eggers Industries.
3. Graham Wood Doors; ASSA ABLOY Group company.
4. Marshfield DoorSystems, Inc.
5. Mohawk Flush Doors, Inc.
6. Oshkosh Door Company.

### 2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."

1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.

B. Regional Materials: Wood doors shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

C. Certified Wood: Wood doors shall be certified as "FSC Pure" according to FSC STD-01-00 and FSC STD-40-004.

D. Adhesives: Do not use adhesives that contain urea formaldehyde.

- E. Composite Wood Products: Products shall be made without urea formaldehyde.
- F. Composite Wood Products: Products shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- G. WDMA I.S.1-A Performance Grade:
  - 1. Heavy Duty unless otherwise indicated.
  - 2. Extra Heavy Duty: Classrooms, public toilets, janitor's closets, assembly spaces.
- H. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.
  - 1. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
  - 2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
  - 3. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- I. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- J. Particleboard-Core Doors:
  - 1. Particleboard: ANSI A208.1, Grade LD-1, made with binder containing no urea-formaldehyde.
  - 2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
  - 3. Provide doors with glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.
- K. Mineral-Core Doors:
  - 1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
  - 2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
  - 3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

## 2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors:



1. Grade: Premium, with Grade AA faces.
2. Species: Natural white birch.
3. Cut: Rotary cut.
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Balance match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Core: Particleboard.
8. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.

#### 2.4 LIGHT FRAMES AND LOUVERS

- A. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
- B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated.

#### 2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied.
- C. Openings: Factory cut and trim openings through doors.
  1. Light Openings: Trim openings with moldings of material and profile indicated.
  2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

#### 2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
  1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors that are indicated to receive transparent finish.
- C. Transparent Finish:

1. Grade: Premium.
2. Finish: WDMA TR-6 catalyzed polyurethane.
3. Staining: As selected by Architect from manufacturer's full range.
4. Effect: Open-grain finish.
5. Sheen: Satin.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
  1. Install fire-rated doors according to NFPA 80.
  2. Install smoke- and draft-control doors according to NFPA 105.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
  1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
    - a. Comply with NFPA 80 for fire-rated doors.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

END OF SECTION 081416

## SECTION 083313 - COILING COUNTER DOORS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Counter doors.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for door-opening framing and corner guards.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of coiling counter door and accessory.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
2. Show locations of controls, locking devices, detectors or replaceable fusible links, and other accessories.
3. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

#### 1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

#### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

## PART 2 - PRODUCTS

### 2.1 COUNTER DOOR MANUFACTURERS

- A. Subject to compliance with requirements, provide products of one of the following:
  - 1. Atlas Door Corp.
  - 2. Overhead Door Corp.
  - 3. Cookson Company
  - 4. North American Door Company, Inc.

### 2.2 COUNTER DOOR ASSEMBLY

- A. Counter Door: Coiling counter door formed with curtain of interlocking metal slats.
- B. Operation Cycles: Door components and operators capable of operating for not less than 100,000.
- C. STC Rating: 26.
- D. Door Curtain Material: Stainless steel.
- E. Door Curtain Slats: Flat profile slats of 1-1/2-inch (38-mm) center-to-center height.
- F. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, fabricated stainless steel and finished to match door.
- G. Curtain Jamb Guides: Stainless steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.
- H. Hood: Stainless steel.
  - 1. Mounting: Face of wall.
- I. Integral Frame, Hood, and Fascia: Stainless steel.
  - 1. Mounting: Face of wall.
- J. Sill Configuration: Integral metal sill.
- K. Locking Devices: Equip door with locking device assembly and chain lock keeper.
  - 1. Locking Device Assembly: Cremona-type, both jamb sides locking bars, operable from inside and outside with cylinders.
- L. Manual Door Operator: Chain-hoist operator.
- M. Curtain Accessories: Equip door with push/pull handles pull-down strap.

- N. Door Finish:
  - 1. Stainless Steel Finish: ASTM A480/A480M No. 4 (polished directional satin).
  - 2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

## 2.3 MATERIALS, GENERAL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.4 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate coiling counter door curtain of interlocking metal slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
  - 1. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.
  - 1. Removable Posts and Jamb Guides: Manufacturer's standard.

## 2.5 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
- B. Integral Frame, Hood, and Fascia: Welded sheet metal assembly of the following sheet metal(s):

## 2.6 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
  - 1. Lock adjustment: Allow for the door to be lock open with a vertical clearance of 12"

2. Lock Cylinders: As standard with manufacturer and keyed to building keying system.
3. Keys: Two for each cylinder.

B. Chain Lock Keeper: Suitable for padlock.

## 2.7 CURTAIN ACCESSORIES

A. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

B. Poll Hooks: Provide pole hooks and poles for doors more than 84 inches (2130 mm) high.

## 2.8 COUNTER DOOR ACCESSORIES

A. Integral Metal Sill: Fabricate sills as integral part of frame assembly of Type 304 stainless steel in manufacturer's standard thickness with ASTM A480/A480M No. 4 finish.

## 2.9 COUNTERBALANCE MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

## 2.10 MANUAL DOOR OPERATORS

A. General: Equip door with manual door operator by door manufacturer.

B. Push-up Door Operation: Design counterbalance mechanism so that required lift or pull for door operation does not exceed **[25 lbf (111 N)]**.

C. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25-lbf (111-N) force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

### 3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Test door release, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed door. Reset door-closing mechanism after successful test.
  - 2. Operational Test: After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
- B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

### 3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain coiling counter doors.

END OF SECTION 083313

## SECTION 083323 - OVERHEAD COILING DOORS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Insulated service doors.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports, door-opening framing, corner guards, and bollards.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
2. Show locations of controls, locking devices detectors or replaceable fusible links, and other accessories.
3. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

#### 1.4 CLOSEOUT SUBMITTALS

A. Special warranty.

B. Maintenance data.

C. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.



1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.
- B. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:
  - 1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward.
  - 2. Testing: According to ASTM E330/E330M.
- C. MANUFACTURERS:
  - 1. Subject to compliance with requirements, provide Overhead Door Corporation coiling overhead door or equal products of one of the following:
    - a. Alpine Overhead Doors, Inc.
    - b. Atlas Door Corp.
    - c. The Cookson Co.
    - d. Cornell Iron Works, Inc.
    - e. Wayne-Dalton Corp.

2.2 DOOR ASSEMBLY

- A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
- B. Operation Cycles: Door components and operators capable of operating for not less than 100,000.
- C. Curtain R-Value: 5.0 deg F x h x sq. ft./Btu (0.881 K x sq. m/W).
- D. Door Curtain Material: Galvanized steel.

- E. Door Curtain Slats: Flat profile slats of 2-5/8-inch (67-mm) center-to-center height.
  - 1. Insulated-Slat Interior Facing: Metal.
- F. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from hot-dip galvanized steel and finished to match door.
- G. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
- H. Hood: Galvanized steel.
  - 1. Mounting: Face of wall.
- I. Locking Devices: Equip door with locking device assembly.
  - 1. Locking Device Assembly: Cremona-type, both jamb sides locking bars, operable from inside and outside with cylinders.
- J. Electric Door Operator:
  - 1. Usage Classification: Medium duty, up to 12 cycles per hour and up to 50 cycles per day.
  - 2. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.
  - 3. Motor Exposure: Interior.
  - 4. Motor Electrical Characteristics:
    - a. Horsepower: 1/2 hp.
    - b. Voltage: 120-V ac, single phase, 60 Hz.
  - 5. Emergency Manual Operation: Chain type.
  - 6. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar pneumatic sensor edge on bottom bar; self-monitoring type.
  - 7. Control Station(s): Interior mounted.
- K. Curtain Accessories: Equip door with weatherseals.
- L. Door Finish:
  - 1. Factory Prime Finish: Manufacturer's standard color.
  - 2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

## 2.3 MATERIALS, GENERAL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.4 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
  - 1. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.
  - 2. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 0.010 inch (0.25 mm).
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

## 2.5 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
  - 1. Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

## 2.6 LOCKING DEVICES

- A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
- B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
  - 1. Lock Cylinders: As standard with manufacturer and keyed to building keying system.
  - 2. Keys: Two for each cylinder.
- C. Chain Lock Keeper: Suitable for padlock.
- D. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

## 2.7 CURTAIN ACCESSORIES

- A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.

## 2.8 COUNTERBALANCE MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

## 2.9 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
  - 1. Comply with NFPA 70.
  - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated for each door assembly.
  - 1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
  - 2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
- D. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.
  - 1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.

- a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained or constant pressure on close button.
- E. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
  - 1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- F. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf (111 N).
- G. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Power-Operated Doors: Install automatic garage doors openers according to UL 325.

#### 3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Test door release, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed door. Reset door-closing mechanism after successful test.
  - 2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, section 5.2.
- B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323

## SECTION 083463 - DETENTION DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Swinging detention doors.
  - 2. Detention frames.

#### 1.2 COORDINATION

- A. Detention Specialist: Coordinate with Section 013513.16 "Special Project Procedures for Detention Facilities" for requirements of this Section that are to be performed by a Detention Specialist or other entity.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: In addition to plans, elevations, sections, and attachment details, provide a schedule using same reference numbers for details and openings as those on Drawings:
- C. Samples: For each exposed finish required.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product test reports.
- C. Anchor inspection reports.
- D. Field quality-control reports.
  - 1. Field quality-control certification, signed by Contractor [ **and Detention Specialist**].

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufactures:

1. Sweeper Metal Fabrications
2. Habersham Metal Product Co.
3. Trussbilt Inc.
4. American Steel Products

B. Source Limitations: Obtain all detention doors and frames from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 DETENTION DOOR AND FRAME ASSEMBLIES

A. Detention Door and Frame Assemblies: ASTM F1450 for security grades specified.

1. Bullet Resistance: Level 3 rated when tested according to UL 752.
2. Tool-Attack Resistance: Small-tool-attack-resistance rated when tested according to UL 437 and UL 1034.

B. Detention Frames: Comply with ASTM F1592 and removable stop test according to NAAMM-HMMA 863.



## 2.4 DETENTION DOORS

- A. General: Provide flush-design detention doors of seamless hollow construction, 2 inches thick unless otherwise indicated. Construct detention doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges.
- B. Core Construction: Provide the following core construction of same material as detention door face sheets, welded to both detention door faces:
  - 1. Steel-Stiffened Core: 0.042-inch- (1.0-mm-) thick, steel vertical stiffeners extending full-door height, with vertical webs spaced not more than 4 inches (102 mm) apart, spot welded to face sheets a maximum of 3 inches (76 mm) o.c. Fill spaces between stiffeners with insulation.
- C. Vertical Edge Channels: 0.123-inch- (3.1-mm-) thick, continuous channel of same material as detention door face sheets, extending full-door height at each vertical edge; welded to top and bottom channels to create a fully welded perimeter channel.
- D. Top and Bottom Channels: 0.123-inch- (3.1-mm-) thick metal channel of same material as detention door face sheets, spot welded, not more than 4 inches (102 mm) o.c., to face sheets.
  - 1. Reinforce top edge of detention door with 0.053-inch- (1.3-mm-) thick closing channel, welded so channel web is flush with top door edges.
- E. Hardware Reinforcement: Fabricate reinforcing plates from same material as detention door face sheets to comply with the following minimum thicknesses:
  - 1. Full-Mortise Hinges and Pivots: 0.187 inch (4.7 mm) thick.
  - 2. Maximum-Security Surface Hinges: 0.250 inch (6.3 mm) thick.
  - 3. Strike Reinforcements: 0.187 inch (4.7 mm) thick.
  - 4. Slide-Device Hanger Attachments: As recommended by device manufacturer.
  - 5. Lock Fronts, Concealed Holders, and Surface-Mounted Closers: 0.093 inch (2.3 mm) thick.
  - 6. All Other Surface-Mounted Hardware: 0.093 inch (2.3 mm) thick.
  - 7. Lock Pockets: 0.123 inch (3.1 mm) thick at non-inmate side, welded to face sheet.
- F. Hardware Enclosures: Provide enclosures and junction boxes for electrically operated detention door hardware of same material as detention door face sheets, interconnected with UL-approved, 1/2-inch- (12.7-mm-) diameter conduit and connectors.
  - 1. Access Plates: Where indicated for wiring installation, provide access plates to junction boxes, fabricated from same material and thickness as face sheet and fastened with at least four security fasteners spaced not more than 6 inches (152 mm) o.c.
- G. Exterior Detention Doors: Construct exterior doors to comply with NAAMM-HMMA 863 and as specified.

1. Security Grade 1: Provide doors with face sheets of 0.093-inch- (2.3-mm-) minimum-thickness, metallic-coated, cold-rolled steel.
2. Security Grade 3: Provide doors with face sheets of 0.067-inch- (1.7-mm-) minimum-thickness, metallic-coated, cold-rolled steel.

## 2.5 DETENTION FRAMES

- A. General: Provide fully welded detention frames with integral stops, of seamless construction without visible joints or seams. Fabricate detention frames with contact edges closed tight and corners mitered, reinforced, and continuously welded full depth and width of detention frame.
- B. Stop Height: Provide minimum stop height of 0.625 inch (16 mm) for detention door openings and minimum stop height of 1-1/4 inches (32 mm) in security glazing or detention panel openings.
- C. Exterior Detention Frames: Construct exterior frames to comply with NAAMM-HMMA 863 and as specified.
  1. [Security Grade 1]: Provide frames fabricated from 0.093-inch- (2.3-mm-) minimum-thickness, metallic-coated, cold-rolled steel.
  2. [Security Grade 3]: Provide frames fabricated from 0.067-inch- (1.7-mm-) minimum-thickness, metallic-coated, cold-rolled steel.
- D. Hardware Reinforcement: Fabricate reinforcing plates from same material as detention frame to comply with the following minimum thicknesses:
  1. Hinges and Pivots: 0.187 inch (4.7 mm) thick by 1-1/2 inches (38 mm) wide by 10 inches (254 mm) long.
  2. Strikes, Flush Bolts, and Closers: 0.187 inch (4.7 mm) thick.
  3. Surface-Mounted Hardware: 0.093 inch (2.3 mm) thick.
  4. Lock Pockets: 0.123 inch (3.1 mm) thick at non-inmate side, welded to face sheet. Provide 0.123-inch- (3.1-mm-) thick, lock protection plate for attachment to lock pocket with security fasteners.
- E. Hardware Enclosures: Provide enclosures and junction boxes for electrically operated detention door hardware, interconnected with UL-approved, 1/2-inch- (12.7-mm-) diameter conduit and connectors.
  1. Access Plates: Where indicated for wiring installation, provide access plates to junction boxes, fabricated from same material and thickness as face sheet and fastened with at least four security fasteners spaced not more than 6 inches (152 mm) o.c.
- F. Mullions and Transom Bars: Fasten mullions and transom bars at crossings and to jambs by butt welding. Reinforce joints between detention frame members with concealed clip angles or sleeves of same metal and thickness as detention frame.

- G. Jamb Anchors: Weld jamb anchors to detention frames near hinges and directly opposite on strike jamb or as required to secure detention frames to adjacent construction.
  - 1. Number of Anchors: Provide two anchors per jamb plus the following:
    - a. Detention Door Frames: One additional anchor for each 18 inches (457 mm), or fraction thereof, above 54 inches (1372 mm) in height.
    - b. Detention Frames with Security Glazing or Detention Panels: One additional anchor for each 18 inches (457 mm), or fraction thereof, above 36 inches (914 mm) in height.
- H. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, formed of same material and thickness as detention frame, and as follows:
- I. Rubber Door Silencers: Except on weather-stripped detention doors, drill stops in strike jambs to receive three silencers on single-detention-door frames and drill head jamb stop to receive two silencers on double-detention-door frames. Keep holes clear during construction.
- J. Grout Guards: Provide factory-installed grout guards of same material as detention frame, welded to detention frame at back of hardware cutouts, silencers, and glazing-stop screw preparations to close off interior of openings and prevent mortar or other materials from obstructing hardware operation or installation.

## 2.6 DETENTION PANELS

- A. Provide fixed detention panels of same materials, construction, and finish as specified for adjoining detention door.

## 2.7 MOLDINGS AND STOPS

- A. Provide fixed moldings on inmate side of glazed openings and removable stops on non-inmate side.
  - 1. Height: As required to provide minimum 1-inch (25-mm) glass engagement, but not less than 1-1/4 inches (32 mm).
  - 2. Fixed Moldings: Formed from same material as detention door and frame face sheets, but not less than 0.093 inch (2.3 mm) thick, and spot welded to face sheets a maximum of 5 inches (127 mm) o.c.
  - 3. Removable Stops: Formed from 0.123-inch- (3.1-mm-) thick angle, of same material as detention door face sheets. Secure with button head security fasteners spaced uniformly not more than 9 inches (229 mm) o.c. and not more than 2 inches (51 mm) from each corner, and as necessary to satisfy performance requirements. Form corners with notched or mitered hairline joints.
- B. Coordinate rabbet width between fixed and removable stops with glass or panel type and installation type indicated.

## 2.8 MATERIALS

- A. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, CS (Commercial Steel), Type B.
- B. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, CS (Commercial Steel), Type B.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, CS (Commercial Steel), Type B; with A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.
- D. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- E. Concealed Bolts: ASTM A307, Grade A.
- F. Masonry Anchors: Same steel sheet as door face.
- G. Embedded Anchors: Hot-dip galvanized according to ASTM A153/A153M.
- H. Post-Installed Anchors: Torque-controlled expansion anchors.
- I. Welding Rods and Bare Electrodes: According to AWS specifications for metal alloy welded.
- J. Glazing: Comply with Section 088853 "Security Glazing."
- K. Grout: Comply with ASTM C476, with a slump of not more than 4 inches (102 mm) as measured according to ASTM C143/C143M.
- L. Insulation: Slag-wool-fiber/rock-wool-fiber or glass-fiber blanket insulation.
- M. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat.
- N. Waterborne Asphaltic Emulsion Coating: Minimum 2.5-mil (0.06-mm) dry film thickness.

## 2.9 FABRICATION

- A. Fabricate detention doors and frames rigid, neat in appearance, and free of defects, warp, or buckle.
- B. Tolerances: Comply with NAAMM-HMMA 863.
- C. Removable Jamb Faces: Provide removable jamb faces where required for access to embedded anchors. Fabricate to allow secure reattachment of removable face with security fasteners.
- D. Fabricate multiple-opening detention frames with mullions that have closed tubular shapes and with no visible seams or joints.

- E. Exterior Detention Doors: Provide weep-hole openings in bottoms of detention doors to permit entrapped moisture to escape. Seal joints in top edges of detention doors against water penetration.
- F. Hardware Preparation: Factory prepare detention doors and frames to receive mortised hardware, including cutouts, reinforcement, mortising, drilling, and tapping, according to final Door Hardware Schedule and templates provided by detention door hardware supplier.
- G. Factory cut openings in detention doors.
- H. Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

#### 2.10 METALLIC-COATED STEEL SHEET FINISHES

- A. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A780/A780M.
- B. Factory Priming for Field-Painted Finish: Apply shop primer immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mil (0.02 mm).
  - 1. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10.

#### 2.11 STEEL SHEET FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning"
- B. Factory Priming for Field-Painted Finish: Apply shop primer immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mil (0.02 mm).
  - 1. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, corrosion-inhibiting, lead- and chromate-free, universal primer complying with SDI A250.10.

#### 2.12 SEALANTS

- A. Security Sealants: Manufacturer's standard, nonsag, tamper-resistant polyurethane sealant.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Before installation and with shipping spreaders removed, adjust detention frames for squareness, alignment, twist, and plumbness to the following tolerances:
  - 1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb and perpendicular to frame head.
  - 2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of face.
  - 3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of door rabbet.
  - 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
- B. Inspect embedded plate installations before installing detention frames to verify that plate installations comply with requirements. Prepare inspection reports.
- C. Anchorage: Set detention frame anchorage devices according to details on Shop Drawings and according to anchorage device manufacturer's written instructions.
- D. Where detention frames are fabricated in sections due to shipping limitations, assemble frames and install angle splices at each corner, of same material and thickness as detention frame, and extend at least 4 inches (102 mm) on both sides of joint.
  - 1. Field splice only at approved locations. Weld, grind, and finish as required to conceal evidence of splicing on exposed faces.
  - 2. Continuously weld and finish smooth joints between faces of abutted, multiple-opening, detention frame members.
- E. Apply bituminous [**waterborne asphaltic emulsion**] coating to backs of frames before filling with grout.
- F. Placing Detention Frames: Install detention frames of sizes and profiles indicated. Set detention frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
- G. Grout: Fully grout detention frame jambs and heads. Completely fill space between frames and adjacent substrates. Hand trowel grout and take other precautions, including bracing detention frames, to ensure that frames are not deformed or damaged by grout forces.
- H. Security Sealant: Apply [**polyurethane**] [**epoxy**] security sealant at all exposed gaps between detention frames and adjacent substrates.
- I. Swinging Detention Doors: Fit non-fire-rated detention doors accurately in their frames, with the following clearances:

- J. Sliding Detention Doors: Fit sliding detention doors in their frames according to manufacturer's written instructions and as required to allow doors to slide without binding.
- K. Fire-Rated Detention Doors: Install with clearances as specified in NFPA 80.
- L. Smoke-Control Detention Doors: Install according to NFPA 105.
- M. Installation Tolerances: Comply with NAAMM-HMMA 863.
- N. Glazing: Comply with installation requirements in Section 088853 "Security Glazing" unless otherwise indicated.
- O. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including detention doors and frames that are warped, bowed, or otherwise unacceptable.

### 3.2 FIELD QUALITY CONTROL

- A. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.
- B. Detention work will be considered defective if it does not pass tests and inspections.
- C. Prepare field quality-control certification[ **endorsed by Detention Specialist**] that states installed products comply with requirements in the Contract Documents.
- D. Prepare test and inspection reports.

END OF SECTION 083463

## SECTION 084113 - ALUMINUM-FRAMED STOREFRONTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Storefront framing

#### 1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
3. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
4. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.

- C. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
2. Include point-to-point wiring diagrams.

- D. Samples: For each type of exposed finish required.

- E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.

- F. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.



1.4 INFORMATIONAL SUBMITTALS

- A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.
- B. Product test reports.
- C. Source quality-control reports.
- D. Field quality-control reports.
- E. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by the International Accreditation Service or the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement as complying with ISO/IEC 17025.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
  - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
  - 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
  - 2. Failure also includes the following:
    - a. Thermal stresses transferring to building structure.
    - b. Glass breakage.
    - c. Noise or vibration created by wind and thermal and structural movements.
    - d. Loosening or weakening of fasteners, attachments, and other components.
    - e. Failure of operating units.
- C. Structural Loads:
  - 1. Wind Loads: As indicated on Drawings.
  - 2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members: At design wind pressure, as follows:
  - 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19.1 mm), whichever is less.
  - 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.
    - a. Operable Units: Provide a minimum 1/16-inch (1.6-mm) clearance between framing members and operable units.
  - 3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
    - a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 11 feet 8-1/4 inches (3.6 m) or 1/175 times span, for spans of less than 11 feet 8-1/4 inches (3.6 m).
- E. Structural: Test according to ASTM E 330/E 330M as follows:
  - 1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.

2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:
  - a. Maximum air leakage of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
2. Entrance Doors:
  - a. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. (2.54 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

H. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas as a system shall have U-factor of not more than 0.41 Btu/sq. ft. x h x deg F (2.33 W/sq. m x K) as determined according to NFRC 100.
2. Condensation Resistance: Fixed glazing and framing areas as a system shall have an NFRC-certified condensation resistance rating of no less than 45 as determined according to NFRC 500.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

## 2.2 STOREFRONT SYSTEMS

A. Basis of Design: Subject to compliance with requirements, provide Tubelite T24650 Series or comparable products by one of the following:

1. Kawneer North America; an Alcoa company.
2. Tubelite Architectural Systems
3. EFCO Corporation.
4. Oldcastle Building Envelope™.
5. TRACO.

- B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
  - 1. Exterior Framing Construction: Thermally broken.
  - 2. Interior Vestibule Framing Construction: Nonthermal.
  - 3. Glazing System: Retained mechanically with gaskets on four sides.
  - 4. Finish: Clear anodic and Color anodic finish. Refer to drawings for finish locations.
  - 5. Fabrication Method: Field-fabricated stick system.
  - 6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
  - 7. Steel Reinforcement: As required by manufacturer.
- C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

## 2.3 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
  - 1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
    - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
  - 2. Door Design: Wide stile; 5-inch (127-mm) nominal width.
  - 3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
    - a. Provide nonremovable glazing stops on outside of door.

## 2.4 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."

## 2.5 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

- C. Glazing Sealants: As recommended by manufacturer.
  - 1. Sealant shall have a VOC content of 250 g/L or less.

## 2.6 MATERIALS

- A. Sheet and Plate: ASTM B 209 (ASTM B 209M).
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
- C. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
- D. Structural Profiles: ASTM B 308/B 308M.
- E. Steel Reinforcement:
  - 1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
  - 2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
  - 3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.
  - 4. Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
- F. Regional Materials: Products shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

## 2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
  - 1. Profiles that are sharp, straight, and free of defects or deformations.
  - 2. Accurately fitted joints with ends coped or mitered.
  - 3. Physical and thermal isolation of glazing from framing members.
  - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  - 5. Provisions for field replacement of glazing from exterior.
  - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

- E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
- F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
- G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## 2.8 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
  - 1. Color: Refer to drawings.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General:
  - 1. Comply with manufacturer's written instructions.
  - 2. Do not install damaged components.
  - 3. Fit joints to produce hairline joints free of burrs and distortion.
  - 4. Rigidly secure nonmovement joints.
  - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
  - 6. Seal perimeter and other joints watertight unless otherwise indicated.
- B. Metal Protection:
  - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
  - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.
- D. Install components plumb and true in alignment with established lines and grades.
- E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

- F. Install glazing as specified in Section 088000 "Glazing."
- G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
  - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
  - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

### 3.2 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.
  - 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
    - a. Perform a minimum of two tests in areas as directed by Architect.
  - 2. Air Infiltration: ASTM E 783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. (0.45 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
    - a. Perform a minimum of two tests in areas as directed by Architect.
- C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 084113

## SECTION 087100 - DOOR HARDWARE

### PART 1 - GENERAL

- 1.1 Refer to "General and Special Conditions", and "Instructions to Bidders", Division 1 of Specifications. Requirements of these Sections and the project drawings shall govern work in this section.
- 1.2 Work Included:
- A. Furnish all items of Finish Hardware specified, scheduled, shown or required herein except those items specifically excluded from this section of the specification.
- B. Related work:
1. Division 00 00 00 - Procurement and Contracting Requirements
  2. Division 01 00 00 - General Requirements
  3. Division 06 00 00 - Wood, Plastics, and Composites
  4. Division 08 00 00 - Openings
  5. Division 10 00 00 - Specialties
  6. Division 11 00 00 - Equipment
  7. Division 26 00 00 - Electrical
  8. Division 27 00 00 - Communications
  9. Division 28 00 00 - Electronic Safety and Security
- C. Specific Omissions: Hardware for the following is specified or indicated elsewhere, unless specifically listed in the hardware sets:
1. Cabinet Hardware.
  2. Signs, except as noted.
  3. Folding partitions, except cylinders where detailed.
  4. Sliding aluminum doors
  5. Chain link and wire mesh doors and gates
  6. Access doors and panels
  7. Overhead and Coiling doors
- 1.3 Quality Assurance
- A. Requirements of Regulatory Agencies:
1. Furnish finish hardware to comply with the requirements of laws, codes, ordinances, and regulations of the governmental authorities having jurisdiction where such requirements exceed the requirements of the Specifications.
  2. Furnish finish hardware to comply with the requirements of the regulations for public building accommodations for physically handicapped persons of the governmental authority having jurisdiction and to comply with Americans with Disabilities Act.
  3. Provide hardware for fire-rated openings in compliance with NFPA 80 and state and local building code requirements. Provide only hardware that has been tested and listed by UL for types and sizes of doors required and complies with requirements of door and door frame labels.
- B. Hardware Supplier:



1. Shall be an established firm dealing in contract builders' hardware. He must have adequate inventory, qualified personnel on staff and be located within 100 miles of the project. The distributor must be a factory-authorized dealer for all materials required. The supplier shall be or have in employment an Architectural Hardware Consultant (AHC).

C. Electrified Door Hardware Supplier:

1. Shall be an experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials.
2. Shall prepare data for electrified door hardware, including shop drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies like those indicated for this project.
3. Shall have experience in providing consulting services for electrified door hardware installations.

D. Pre-installation Meeting:

1. Before hardware installation, General Contractor/Construction Manager will request a hardware installation meeting be conducted on the installation of hardware; specifically, that of locksets, closers, exit devices, overhead stops and coordinators. Manufacturer's representatives of the above products, in conjunction with the hardware supplier for the project, shall conduct the meeting. Meeting to be held at job site and attended by installers of hardware for aluminum, hollow metal and wood doors. Meeting to address proper coordination and installation of hardware, per finish hardware schedule for this specific project, by using installation manuals, hardware schedule, templates, physical product samples and installation videos.
2. When any electrical or pneumatic hardware is specified this meeting shall also include the following trades/installers: Electrical, Security, Alarm systems and Architect.
3. Convene one week or more prior to commencing work of this Section.
4. The Hardware Supplier shall include the cost of this meeting in his proposal.

E. Manufacturer:

1. **Mandatory: all manufacturers of door hardware are to match the existing facility.**
2. Obtain each type of hardware (latch and locksets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
3. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.

1.4 Submittals:

A. Hardware Schedule

1. Submit number of Hardware Schedules as directed in Division 1.
2. Follow guidelines established in Door & Hardware Institute Handbook (DHI) Sequence and Format for the Hardware Schedule unless noted otherwise.
3. Schedule will include the following:
  - a. Door Index including opening numbers and the assigned Finish Hardware set.
  - b. Preface sheet listing category only and manufacturer's names of items being furnished as follows:

CATEGORY	SPECIFIED	SCHEDULED
----------	-----------	-----------

Hinges	Manufacturer A	Manufacturer B
Lock sets	Manufacturer X	Manufacturer X
Kick Plates	Open	Manufacturer Z

- c. Hardware Locations: Refer to Article 3.1 B.2 Locations.
- d. Opening Description: Single or pair, number, room locations, hand, active leaf, degree of swing, size, door material, frame material, and UL listing.
- e. Hardware Description: Quantity, category, product number, fasteners, and finish.
- f. Headings that refer to the specified Hardware Set Numbers.
- g. Scheduling Sequence shown in Hardware Sets.
- h. Product data of each hardware item, and shop drawings where required, for special conditions and specialty hardware.
- i. Electrified Hardware system operation description.
- j. "Vertical" scheduling format only. "Horizontal" schedules will be returned "Not Approved."
- k. Typed Copy.
- l. Double-Spacing.
- m. 8-1/2 x 11-inch sheets
- n. U.S. Standard Finish symbols or BHMA Finish symbols.

B. Product Data:

- 1. Submit, in booklet form Manufacturers Catalog cut sheets of scheduled hardware.
- 2. Submit product data with hardware schedule.

C. Samples:

- 1. Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit one sample, if required, of each type of exposed hardware unit, finished as required and tagged with full description for coordination with schedule.
- 2. Samples will be returned to the supplier. Units, which are acceptable and remain undamaged through submittal, review and field comparison procedures may, after final check of operation, be used in the work, within limitations of keying coordination requirements.

D. Key Schedule:

- 1. Submit detailed schedule indicating clearly how the Owner's final keying instructions have been followed.
- 2. Submit as a separate schedule.

E. Electrified Hardware Drawings:

- 1. Submit elevation drawings showing relationship of all electrical hardware components to door and frame.
  - a. Include wiring drawing showing point to point wire hook up for all components.
  - b. Include system operations descriptions for each type of opening; describe each possible condition.

F. Submit to General Contractor/Construction Manager, the factory order acknowledgement numbers for the various hardware items to be used on the project. The factory order acknowledgement numbers shall help to facilitate and expedite any service that may be required on a hardware item. General Contractor/Construction Manager shall keep these order acknowledgement numbers on file in the construction trailer.

1.5 Product Delivery, Storage, and Handling:

- A. Label each item of hardware with the appropriate door number and Hardware Schedule heading number and deliver to the installer so designated by the contractor.

1.6 Warranties:

- A. During the warranty period, replace defective work, including labor, materials and other costs incidental to the work. Replace work found to be defective as defined in the General Conditions.

PART 2 - PRODUCT

2.1 **Mandatory: all manufacturers of door hardware are to match the existing facility.**

2.2 Furnish each category with the products of only one manufacturer unless specified otherwise; this requirement is **mandatory** whether various manufacturers are listed or not.

2.3 Provide the products of manufacturer designated or if more than one manufacturer is listed, the comparable product of one of the other manufacturers listed. Where only one manufacturer or product is listed, it is understood that this is the owner's Building Standard and "no substitution" is allowed.

A. Hinges:

1. Furnish hinges of class and size as follows.
2. Furnish Ives 5BB1HW 4.5" x 4.5" (For Reference Only).
  - a. **Match existing facility manufacturer.**

B. Continuous Gear Hinge:

1. 6063-T6 aluminum alloy, anodized finish (cap on entire hinge painted if specified). Manufacture to template, uncut hinges non-handed, pin less assembly, three interlocking extrusions, full height of door and frame, lubricated polyacetal thrust bearing, fasteners 410 stainless steel plated and hardened. Anodizing of material shall be done after fabrication of components so that all bearing slots are anodized.
2. Length: 1" less than door opening height. Fastener 12-24 x 1/2" #3 Phillips keen form stainless steel self-tapping at aluminum and hollow metal doors, 12- 1/2" #3 Philips, flathead full thread at wood doors.
3. Furnish fire rated hinges "FR" at labeled openings.
  - a. For Wood and Hollow Metal frames;
    - 1) Ives 224XY (For Reference Only)
    - 2) Match existing facility manufacturer.
  - b. For Aluminum frames;
    - 1) Ives 112XY (For Reference Only)
    - 2) Match existing facility manufacturer.

C. Flush Bolts (For reference only - match existing facility manufacturer)

1. Automatic - metal doors:
  - a. Ives FB30 Series

- b. Equal product of any B.H.M.A. member.
  2. Automatic - wood doors:
    - a. Ives FB40 Series
    - b. Equal product of any B.H.M.A. member.
  3. Constant Latching: metal doors:
    - a. Ives FB50 Series
    - b. Equal product of any B.H.M.A. member.
  4. Constant Latching: wood doors:
    - a. Ives FB60 Series
    - b. Equal product of any B.H.M.A. member.
  5. Manual - wood and metal doors:
    - a. Ives FB458 Series
    - b. Equal product of any B.H.M.A. member.
  6. Dust Proof Strikes - furnish with all flush bolts, except at openings having thresholds:
    - a. Ives DP2
    - b. Equal product of any B.H.M.A. member.
- D. Locksets and Latch sets - Heavy Duty: (For reference only - match existing facility manufacturer)
  1. Function numbers listed are or Schlage
  2. Provide 2-3/4 inch backset.
  3. Provide strikes with extended lips where required to protect trim from being marred by latch bolt. Provide strike lips that do not project more than 1/8" beyond doorframe trim at single doors, have 7/8" lip to center at pairs of 1-3/4" doors and rose size 3 1/2 diameter
  5. Locksets and Latch sets:
    - a. Schlage L9000 series
  6. Lockset Trim:
    - a. Schlage HSLR and O3A
- E. Roller Latches: (For reference only - match existing facility manufacturer)
  - a. Ives RL30
- F. Exit Devices:
  1. Exit devices shall be touchpad style, fabricated of brass, bronze, stainless steel, or aluminum, plated to the standard architectural finishes to match the balance of the door hardware.
  2. All exit devices shall incorporate a fluid damper, which decelerates the touchpad on its return stroke and eliminates noise associated with exit device operation. Touchpad shall

- extend a minimum of one half of the door width. All latch bolts to be dead latching type, with a self-lubricating coating to reduce wear.
3. Endcap will be sloped to deflect any impact from carts, and they shall be flush with the external mechanism case. End caps that overlap and project above the mechanism case are unacceptable. End cap shall utilize a two-point attachment to the mounting bracket.
  4. Touchpad shall match exit device finish, and shall be stainless steel for US26, US26D, US28, US32, and US32D finishes. Only compression springs will be used in devices, latches, and outside trims or controls.
  5. Plastic templates shall be included with each exit device to facilitate a quick, easy and accurate installation.
  6. Strikes shall be roller type and come complete with a locking plate to prevent movement.
  7. All rim and vertical rod exit devices shall have passed a 5 million (5,000,000) cycle test based on ANSI A156.3, 1994, Grade 1 test standards and certified by an independent testing lab.
  8. All mortise exit devices shall have passed a 10 million (10,000,000) cycle test based on ANSI A156.3, 1994, Grade 1 test standards and certified by an independent testing lab.
  9. Exit devices shall be UL listed panic exit hardware. All exit devices for fire rated openings shall be UL labeled fire exit hardware.
  10. Lever trim for exit devices shall be vandal-resistant type, which will travel to a 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.
  11. Von Duprin 98/99 and 33A/35A Series. Series and function numbers as listed in sets.
  12. Trim: Von Duprin 990 pull trim, 5 standard functions:
    - a. Classroom (TP)
    - b. Storeroom (NL)
    - c. Dummy trim (DT)
    - d. Passage (TP-BE)
    - e. Exit only (EO)

Trim: Von Duprin 33A/35A Series popular trims 360: lever or thumbpiece trim, 3 standard functions:

    - a. Classroom (L, T)
    - b. Passage (L-BE, T-BE)
    - c. Dummy (L-DT)

386: pull trim, 2 standard functions:

    - a. Storeroom (NL)
    - b. Dummy (DT)

388: optional pull trim, 1 standard function:

    - a. Storeroom (NL-OP)
  13. Von Duprin 98/99 and 33A/35A QELA Baseplate Conv. Kit series.
  14. Schlage PS902 with a Von Duprin 900-4RL is a 4-relay distribution board is a 2-amp 12/24 VDC output power supply for connection of electrified devices such Von Duprin exit devices equipped with the (QELA Baseplate Conv. kit series.)

G. Recessed Exit Devices:

1. Recessed exit devices shall be of the push pad design with straight or horizontal motion to eliminate pinch points. The push pad shall project a maximum of 1-3/4" from the face of the door in the closed position. The push pad shall project a maximum of 1-1/4" from the face of the door in the open position.
2. Latch bolts shall have a self-lubricating coating to reduce friction and wear.
3. Endcaps shall be diecast aluminum and be of a sloping design to deflect impact from carts.

4. Exit devices shall have compression springs, and all internal parts shall be zinc dichromate coated to prevent corrosion.
  5. Outside trim shall be heavy-duty type and fasten by means of concealed studs and through-bolt from the inside. Lever trim shall be cast brass with a minimum average thickness of .130".
  6. Exit devices shall be tested in accordance to ANSI/BHMA A156.3 Grade 1 by a BHMA certified testing laboratory.
  7. A written certification showing successful completion of a minimum of one million cycles must be also provided.
  8. Recessed exit devices shall be as manufactured by Von Duprin. Exit device series shall be 94/95 series.
  9. Trim:
    - a. Levers to match lockset design.
- H. Removable Mullion:
- a. Interior/Exterior doors, mullion is removable only using building keys.
    - 1) Match Existing
  - b. Interior Doors - UL listed, Mullion is removable only using building keys.
    - 1) Match Existing
- I. Push and Pull Hardware: (For reference only - match existing facility manufacturer)
1. Push Plates: Ives 8200 Series 6 x 16 x .050 inches. If stile widths will not accept 6 inches, provide stile width less two inches.
  2. Push Bars: Von Duprin 330/350
  3. Push-Pull Units: One-inch round rod. Push: Straight push bar, Pull: 90-degree offset, 12-inch centers. Attach top post of pull back to back with latch stile end of push bar, bottom post of pull and hinge stile end of push bar with endcaps.
  4. Pull, Offset: One-inch round rod, 90-degree offset, 12-inch centers.
  5. Pulls: One-inch round rod, straight 12-inch centers.
  6. Pull Plates: Ives 8303-8 4 x 16 x .050 inches. 8" center.
  7. Pull, Bi-Fold: Dummy Lever Trims. Levers to match lockset lever design.
  8. Pull, Wire: 3/4-inch diameter, 6-inch centers.
  9. Vandal Resistant Pulls: Ives VR900 Series. Stainless steel construction 0.120 inches thick.
  10. Manufacturer: Provide push and pull hardware from any member of B.H.M.A.
- J. Coordinator - Frame Stop Mounted:
1. Door coordinator shall prevent the active door from closing before inactive door. Stop mounted channel 1-5/8" x 5/8" steel tubing x length to suit door opening. Coordinator shall be UL listed. Furnish filler bars to fill gap between end of coordinator and inactive door frame. Furnish mounting brackets for all stop mounted hardware such as exit device strikes, door closer PA shoes, etc. Coordinators shall be prepared (cutout) at the factory for surface applied or concealed vertical rod panic devices if required.
  2. Furnish with carry bar CB1 when required for proper operation.
    - a. Ives COR x length to suit.
- K. Electric Strike:
1. Electric strikes shall provide remote release of latch bolts. They shall be designed for use with the type locks shown at each opening where required. Strikes will be UL Listed for Burglary-Resistant Electric Door Strike, and where required, shall be UL listed as electric strikes for Fire Doors or Frames. Faceplates shall be stainless steel with finish as specified for each opening. The locking components shall be stainless steel to resist damage and abuse.

2. Solenoids shall be of the continuous duty type for the voltage specified. Plug connectors will be furnished. Strikes shall have an adjustable backbox to compensate for misalignment of door and frame.
  3. Furnish strikes manufactured by VonDuprin
    - a. Von Duprin 6000 Series
    - b. Alternative subject to approval from DTMB Office of Infrastructure Protection, Security Program Coordinator
- L. Electric Power Transfer:
1. Transfer power from door frame to edge of door, UL listed R4504.
  2. Von Duprin EPT
- M. Access control wire - Profusion Genesis series cable 22/6+22/4+22/2+18/4 - Plenum or FTS.
- N. Closers:
1. Door closers shall have fully hydraulic, full rack and pinion action with a high strength cast iron cylinder. Cylinder body shall be 1 ½" in diameter, and double heat-treated pinion shall be 11/16" in diameter with double D slab drive arm connection.
  2. Hydraulic fluid shall be of a type requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
  3. Spring power shall be continuously adjustable over the full range of closer sizes and allow for reduced opening force for the physically handicapped. Hydraulic regulation shall be by tamper- proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and backcheck.
  4. All closers shall have solid forged steel main arms (and forged forearms for parallel arm closers).
  5. All surface mounted mechanical closers shall be certified to exceed ten million (10,000,000) full load cycles by a recognized independent testing laboratory.
  6. Closers will have Powder coating finish certified to exceed 100 hours salt spray testing by ETL, an independent testing laboratory used by BHMA for ANSI certification.
  7. Refer to door and frame details and furnish accessories such as drop plates, panel adapters, spacers and supports as required to correctly install door closers. State degree of door swing in the hardware schedule.
  8. Furnish closers manufactured by LCN
    - a. LCN Series 4000.
- O. ADA Special Closers
1. Where "Low Energy Power Operated Door" as defined by ANSI Standard A156.19 is indicated for doors required to be accessible to the disabled, provide electrically powered operators complying with the ADA requirements for opening force and time to close standards.
  2. Full closing force shall be provided when the power or assist cycle ends.
  3. Modular design, adjustments easily accessible from the front, UL listed for use on labeled doors.
  4. Shall have "Second Chance" function to accommodate momentary resistance, "Breakaway" function in the electronically controlled clutch, "Soft Start" motor control function and "Maintain Hold-Open Switch" to hold the door open at 90 degree.

5. Shall have built in 12V and 24V power supply for actuators, card readers, electric strikes and magnetic door locks, inputs for both swing and stop side sensors and available to accept either 120VAC or 220VAC input power. All wiring connections between operator modules made by easy- to-handle electrical connectors. Shall comply with both UL and NEC requirements for Class 1 and Class 2 wiring by providing separate conduits for each.
6. Shall have seven independent electronic adjustments to tailor the operator for specific site conditions. Opening speed, holding force at 90 deg., sequential trigger and time delay, hold-open time at 90 deg., opening force, clutch "breakaway" force setting, electric strike trigger and time delay.
7. Shall have separate and independent adjustments for back check, main speed and latch speed.
8. Furnish actuators and other controls as shown in Hardware Sets.
9. Furnish operators manufactured by:
- 10. All installers must be certified by the American Association of Automatic Door Manufacturers (AAADM) is a trade association of power-operated automatic door manufacturers.**
  - a. Stanley Magic Force
  - b. LCN 4630/4640 Auto Equalizer™ Series Operators

P. Overhead Holders and Stops:

1. Type, function and fasteners must be same as Glynn-Johnson specified. Size per manufacturer's selector chart. Plastic end caps hold open mechanisms and shock blocks are not allowed. End caps must be finished same as balance of unit.
2. Manufacture products using base material of Brass/Bronze for US3, US4, & US10B finished products and 300 Stainless Steel for US32 & US32D finished products.
3. Type, function, and fasteners must be the same as Glynn-Johnson specified. Size per manufacturer's selector chart.
  - a. Von Duprin -Glynn-Johnson

Q. Kick Plates:

1. Furnish .050 inches thick, beveled three sides, 10" high x door width less 2" at single doors and less 1" at pairs. Where glass or louvers prevent this height, supply with height equal to height of bottom rail less 2".
2. Any BHMA manufacturing product meeting above is acceptable.

R. Bumpers:

1. Wrought, forged, or cast, approximately 2-1/2 inch diameter, convex or concave rubber center, concealed fasteners.
  - a. Ives WS407CCV
  - b. BHMA L02101.

S. Wall Stops:

1. Length to exceed projection of all other hardware. Provide with threaded studs and expansion shields for masonry wall construction. Install with slope at top.
  - a. Ives WS33
  - b. BHMA L12011 or L12021

T. Floor Stops:



1. Half dome. Furnish height to suit undercut.
  - a. Ives FB430 series
  - b. BHMA L12141

U. Wall Holders:

1. Products specified by series only; furnish strike length to exceed projection of all other hardware.
  - a. Ives WS40
  - b. Equal products of any BHMA manufacturer

V. Door Holding Magnets:

1. Electrically controlled, fail-safe, holds door open until current is interrupted.
2. Units will have 35 lbs. of holding force.
3. Units will be "tri-voltage", 12VDC, 24VAC/DC & 120VAC.
4. Furnish model to hold door away from wall to allow for any trim or levers on pull side of door.
  - a. LCN SEM 7800 series

W. Thresholds:

1. 1/2" high - 5" wide. Cope at jambs.
2. Furnish full wall opening width when frames are recessed.
3. Cope in front of mullions if thresholds project beyond door faces.
4. Furnish with non-ferrous Stainless-Steel Screws and Lead Anchors.
  - a. Zero as listed in sets
  - b. Equal of NGP or Reese

X. Door Sweeps:

1. Surface Sweeps:
  - a. Zero as listed in sets
  - b. Equal of NGP or Reese

Y. Weather-stripping:

1. Apply to head and jamb stops.
2. Solid Bar stock all sides
  - a. Zero as listed in sets
  - b. Equal by Zero or

Reese

AA. Meeting Stile Weather-stripping:

3. 2 Pc. Nylon brush type to seal gap between pairs of doors.
  - a. Zero as listed in sets
  - b. Equal by NGP or Reese

BB. Astragal:

1. Stainless steel, type 304, Finish 2B. 12 gauge 1-5/8 inch wide. #10 x 3/4" sheet metal screws.
  - a. Zero as listed in sets
  - b. Equal by NGP or Reese



2.5 Templates and Hardware Location:

- A. Furnish hardware made to template. Supply required templates and hardware locations to the door and frame manufacturers.
- B. Furnish metal template to frame/door supplier for continuous hinge.
- C. Refer to Article 3.1 B.2, Locations, and coordinate with templates.

2.6 Cylinders and Keying:

- A. Locks Cylinders and keys will be furnished with Schlage standard core or Best Small Format Interchangeable Core (SFIC). Coordinate keying requirements with State of Michigan Department of Technology, Management and Budget, Office of Infrastructure Protection.
- B. Provide cylinders with construction cores or keying for use during the construction period. When so directed, and in the presence of the Owner's security department or representative, convert construction cores or keying to the final system.

PART 3 - EXECUTION

3.1 Installation

A. General:

- 1. Install hardware according to manufacturer's installations and template dimensions. Attach all items of finish hardware to doors, frames, walls, etc. with fasteners furnished and required by the manufacture of the item.
- 2. Provide blocking/reinforcement for all wall mounted Hardware.
- 3. Reinforced hollow metal doors and frames and reinforced aluminum door and frames will be drilled and tapped for machine screws.
- 4. Solid wood doors and frames: full thread wood screws. Drill pilot holes before inserting screws.
- 5. Continuous gear hinges attached to hollow metal doors and frames and aluminum doors and frames: 12-24 x 1/2" #3 Phillips Keen form self-tapping. Use #13 or 3/16 drill for pilot.
- 6. Continuous Gear Hinges require continuous mortar guards of foam or cardboard 1/2" thick x frame height, applied with construction adhesive.
- 7. Install weather-strip gasket prior to parallel arm closer bracket, rim exit device or any stop mounted hardware. Gasket to provide a continuous seal around perimeter of door opening. Allow for gasket when installing finish hardware. Door closers will require special templating. Exit devices will require adjustment in backset.

B. Locations:

- 1. Dimensions are from finish floor to center line of items.
- 2. Include this list in Hardware Schedule.

CATEGORY

DIMENSION

Hinges

Door Manufacturer's Standard

Flush Bolt Levers	72" and 12"
Levers	Door Manufacturer's Standard
Exit Device Touch Bar	Per Template
Dead latch Cylinder pull.	43" unless conflicting with push-
Deadlock MS Cylinder pull.	43" unless conflicting with push-
Hospital Push-Pull	Manufacturer's Template
Roller Latch	At Head
Push-Pull Units	42" to centerline of Pull
Offset Pulls	Suitable for Exit Devices
Pulls - Flush Cup	46"
Pulls (BTB)	46"
Push-Pulls	46"
Push Plates	52"
Pull Plates	42"
Wire Pulls	42"
Wall Stops/holders	At Head
Astragals	Pull side of active leaf
Trim Protector Bars handle	Push side of door below lever
Lock Protectors	Pull side of door

C. Field Quality Inspection:

1. Provide the services of a representative to inspect material furnished and its installation and is adjustment, and to instruct the Owner's personnel in adjustment, care and maintenance of hardware.
2. Locksets and exit devices shall be inspected by the factory representative after installation and after the HVAC system is in operation and balanced, to insure correct installation and proper operation.
3. Closers shall be inspected by the factory representative (**and adjusted when required after a Pre- Installation meeting has been conducted**) after installation and after the HVAC system is in operation and balanced, to insure correct installation and proper operation.
4. The manufacturer's representative shall prepare a written report stating compliance and recording locations and kinds of noncompliance. The original report shall be forwarded to the Architect with copies to the Contractor, hardware distributor, hardware installer and building owner.

D. Technical and Warranty Information:

1. At the completion of the project, the technical and warranty information coalesced and kept on file by the General Contractor/Construction Manager shall be given to the Owner or Owner's Agent. In addition to both the technical and warranty information, all factory order acknowledgement numbers supplied to the General Contractor/Construction Manager during the construction period shall be given to the Owner or Owner's Agent. The warranty information and factory order acknowledgement numbers shall serve to both expedite and properly execute any warranty work that may be required on the various hardware items supplied on the project.
2. Submit to General Contractor/Construction Manager, two copies each of parts and service manuals and two each of any special installation or adjustment tools. Include for locksets, exit devices, door closers and any electrical products

Hardware Group No. 01

H120.D H120.E

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112HD EPT		628	IVE
1	EA	POWER TRANSFER	EPT10		⚡ 689	VON
1	EA	EU MORTISE LOCK	L9095BDEU 03A RX CON 12/24 VDC		⚡ 626	SCH
1	EA	H-SEC SURFACE CLOSER	4211 AVB CUSH		689	LCN
1	SET	WEATHER SEAL	(BY DOOR & FRAME MFR)			
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	656A-V3-223		A	ZER
1	EA	POWER SUPPLY	(BY SECURITY CONTRACTOR)			
2	EA	ACCESS CONTROL	(BY SECURITY CONTRACTOR)		⚡	
1	EA	DOOR CONTACT	679-05		⚡ BLK	SCE

PRESENTING AN AUTHORIZED CREDENTIAL WILL UNLOCK THE LEVER TO ALLOW PASSAGE THROUGH THE OPENING. AN AUTHORIZED CREDENTIAL IS REQUIRED ON EACH SIDE OF THE OPENING.

COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE USER, THE ARCHITECT AND ALL RELATED TRADES.

Hardware Group No. 02

H122.A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224HD EPT		628	IVE
1	EA	POWER TRANSFER	EPT10		⚡ 689	VON
1	EA	EU MORTISE LOCK	L9095BDEU 03A RX LX DPS CON 12/24 VDC		⚡ 626	SCH
1	EA	H-SEC SURFACE CLOSER	4511T AVB		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS TKTX		630	IVE
1	EA	WALL STOP	KG183		BLK	KIN
1	EA	GASKETING	488SBK PSA ZAG		BK	ZER
1	EA	WIRE HARNESS	CON-44		⚡	SCH
1	EA	POWER SUPPLY	(BY SECURITY CONTRACTOR)			
2	EA	ACCESS CONTROL	(BY SECURITY CONTRACTOR)		⚡	
1	EA	DOOR CONTACT	679-05		⚡ BLK	SCE

PRESENTING AN AUTHORIZED CREDENTIAL WILL UNLOCK THE LEVER AND ALLOW PASSAGE THROUGH THE OPENING. A VALID CREDENTIAL IS REQUIRED ON EACH SIDE OF THE OPENING.

THIS OPENING IS PART OF A SECURITY INTERLOCK WITH OPENING H131.2

COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE USER, THE ARCHITECT AND ALL RELATED TRADES.

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 Saline, Michigan

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Hardware Group No. 03  
 H131.B

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224HD EPT SECWDHM		628	IVE
1	EA	POWER TRANSFER	EPT10		⚡ 689	VON
1	EA	EU MORTISE LOCK	L9095BDEU 03A RX LX DPS CON 12/24 VDC		⚡ 626	SCH
1	EA	H-SEC SURFACE CLOSER	4511T AVB		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS TKTX		630	IVE
1	EA	WALL STOP	KG183		BLK	KIN
1	EA	GASKETING	488SBK PSA ZAG		BK	ZER
1	EA	WIRE HARNESS	CON-44		⚡	SCH
1	EA	POWER SUPPLY	(BY SECURITY CONTRACTOR)			
2	EA	ACCESS CONTROL	(BY SECURITY CONTRACTOR)		⚡	
1	EA	DOOR CONTACT	679-05		⚡ BLK	SCE

PRESENTING AN AUTHORIZED CREDENTIAL WILL UNLOCK THE LEVER AND ALLOW PASSAGE THROUGH THE OPENING. A VALID CREDENTIAL IS REQUIRED ON EACH SIDE OF THE OPENING.

THIS OPENING IS PART OF A SECURITY INTERLOCK WITH OPENING H122.1  
 COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE USER, THE ARCHITECT AND ALL RELATED TRADES.






Hardware Group No. 04  
 H126.1

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	PRIVACY W/COIN TURN	L9044 03A 09-544 L283-722		626	SCH
1	EA	SURFACE CLOSER	4011 MC		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS TKTX		630	IVE
1	EA	WALL STOP	WS447		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 05  
 H130.B

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224HD SEC		628	IVE
1	EA	ANTILIGATURE TIP	TIPIT		628	SEL
1	EA	CLASSROOM LOCK	L9070BDC HSLR 09-663		630	SCH
1	EA	H-SEC SURFACE CLOSER	4211 AVB EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS TKT		630	IVE
1	EA	MAGNETIC HOLDER	2400LR		689	ABH
1	EA	GASKETING	488SBK PSA ZAG		BK	ZER

DOORS MAY BE HELD-OPEN ELECTRONICALLY. UPON ACTIVATION OF THE BUILDING FIRE ALARM SYSTEM, THE DOORS WILL CLOSE AND POSITIVELY LATCH. COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT AND ALL RELATED TRADES.








Hardware Group No. 06  
 H120.B            H120.C            H131.D

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1			(ALL HDWE BY DOOR MFR)			

Hardware Group No. 07  
 H131.C            H132.C






EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112HD EPT SEC		628	IVE
2	EA	ANTILIGATURE TIP	TIPIT		628	SEL
2	EA	POWER TRANSFER	EPT10		⚡ 689	VON
2	EA	TWO PT EU MORT LOCK	LM9295EUBDC 03A CON 12/24 VDC		⚡ 626	SCH
2	EA	H-SEC SURFACE CLOSER	4211 AVB CUSH		689	LCN
1	SET	WEATHER SEAL	(BY DOOR & FRAME MFR)			
2	EA	DOOR SWEEP	39A SEC		A	ZER
1	EA	THRESHOLD	656A-V3-223		A	ZER
1	EA	POWER SUPPLY	(BY SECURITY CONTRACTOR)			
2	EA	KEYPAD	(BY SECURITY CONTRACTOR)			
2	EA	DOOR CONTACT	679-05		⚡ BLK	SCE

PRESENTING AN AUTHORIZED PIN WILL UNLOCK THE LEVER TO ALLOW PASSAGE THROUGH THE OPENING. AN AUTHORIZED PIN IS REQUIRED ON EACH SIDE OF THE OPENING. COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE USER, THE ARCHITECT AND ALL RELATED TRADES.






Hardware Group No. 08  
 E126.A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224HD		628	IVE
2	EA	ANTILIGATURE TIP	TIPIT		628	SEL
2	EA	FIRE EXIT HARDWARE	9849-L-BE-F-03-LBL		626	VON
1	EA	H-SEC SURFACE CLOSER	4211 AVB CUSH		689	LCN
1	EA	H-SEC SURFACE CLOSER	4211 AVB EDA		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS TKTX		630	IVE
2	EA	MAGNETIC HOLDER	2400LR		689	ABH






Hardware Group No. 09  
 H125.A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050BDC 03A 09-544		626	SCH
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS447		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER






Hardware Group No. 10  
 H124.A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224HD		628	IVE
1	EA	CLASSROOM LOCK	L9070BDC 03A		626	SCH
1	EA	OH STOP	90S J		630	GLY
1	EA	ARMOR PLATE	8400 36" X 1 1/2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA ZAG		BK	ZER

Hardware Group No. 11  
 H127.A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	CLASSROOM LOCK	L9070BDC 03A		626	SCH
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS TKTX		630	IVE
1	EA	WALL STOP	WS447		626	IVE
1	EA	GASKETING	488SBK PSA ZAG		BK	ZER



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Hardware Group No. 12

E124.C H133.A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224HD EPT SECWDHM		628	IVE
1	EA	ANTILIGATURE TIP	TIPIT		628	SEL
1	EA	POWER TRANSFER	EPT10		⚡ 689	VON
1	EA	EL MORTISE LOCK	L9095BDEL HSLR 09-663 RX LX CON 12/24 VDC		⚡ 630	SCH
2	EA	SFIC MORTISE CYL.	80-102		626	SCH
1	EA	H-SEC SURFACE CLOSER	4211 AVB CUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS TKTX		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	POWER SUPPLY	(BY SECURITY CONTRACTOR)		⚡	
2	EA	ACCESS CONTROL	(BY SECURITY CONTRACTOR)		⚡	
1	EA	DOOR CONTACT	679-05		⚡ BLK	SCE

COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE USER, THE ARCHITECT AND ALL RELATED TRADES.

Hardware Group No. 13

H121.A H200.A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	L9080BDC 03A		626	SCH
1	EA	SURFACE CLOSER	4011 MC		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS33X		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 13.1

H132.B

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224HD		628	IVE
1	EA	ANTILIGATURE TIP	TIPIT		628	SEL
1	EA	STOREROOM LOCK	L9080BDC HSLR 09-663		630	SCH
1	EA	SURFACE CLOSER	4011 MC		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS33X		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 14  
 H131.A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224HD SEC	<a href="#">📄</a>	628	IVE
1	EA	PANIC HARDWARE	9849-EO-LBL-SEC	<a href="#">📄</a>	626	VON
1	EA	PANIC HARDWARE	9875-HL-576A-SEC	<a href="#">📄</a>	626	VON
1	EA	SFIC MORTISE CYL.	80-102		626	SCH
2	EA	H-SEC SURFACE CLOSER	4211 AVB EDA	<a href="#">📄</a>	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS TKTX	<a href="#">📄</a>	630	IVE
2	EA	MAGNET	SEM7820 12V/24V/120V	<a href="#">📄</a>	689	LCN

DOORS MAY BE HELD-OPEN ELECTRONICALLY. UPON ACTIVATION OF THE BUILDING FIRE ALARM SYSTEM, THE DOORS WILL CLOSE AND POSITIVELY LATCH. COORDINBATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT AND ALL RELATED TRADES.

Hardware Group No. 15  
 H201.A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224HD	<a href="#">📄</a>	628	IVE
1	EA	DBL CYL STORE W/DB	L9466BDC 03A	<a href="#">📄</a>	626	SCH
1	EA	SURFACE CLOSER	4111 SHCUSH MCSRI	<a href="#">📄</a>	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	<a href="#">📄</a>	630	IVE
1	SET	GASKETING	429AA-S	<a href="#">📄</a>	AA	ZER
1	EA	DOOR SWEEP	39A	<a href="#">📄</a>	A	ZER
1	EA	THRESHOLD	656A-V3-223	<a href="#">📄</a>	A	ZER

Hardware Group No. 16  
 H132.A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224HD SEC	<a href="#">📄</a>	628	IVE
1	EA	FIRE EXIT HARDWARE	9849-EO-F-LBL-SEC	<a href="#">📄</a>	626	VON
1	EA	FIRE EXIT HARDWARE	9875-HL-F-576A-SEC	<a href="#">📄</a>	626	VON
1	EA	SFIC MORTISE CYL.	80-102		626	SCH
2	EA	H-SEC SURFACE CLOSER	4211 AVB EDA	<a href="#">📄</a>	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS TKTX	<a href="#">📄</a>	630	IVE
2	EA	MAGNETIC HOLDER	2400LR		689	ABH

DOORS MAY BE HELD-OPEN ELECTRONICALLY. UPON ACTIVATION OF THE BUILDING FIRE ALARM SYSTEM, THE DOORS WILL CLOSE AND POSITIVELY LATCH. COORDINBATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT AND ALL RELATED TRADES.

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Hardware Group No. 17  
 H120.A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224HD EPT		628	IVE
2	EA	POWER TRANSFER	EPT10	⚡	689	VON
2	EA	TWO PT EU MORT LOCK	LM9295EUBDC 03A CON 12/24	⚡	626	SCH
		VDC				
2	EA	H-SEC SURFACE CLOSER	4211 AVB CUSH		689	LCN
2	EA	ARMOR PLATE	8400 36" X 1" LDW B-CS		630	IVE
2	EA	MAGNET	SEM7820 12V/24V/120V	⚡	689	LCN
2	EA	WIRE HARNESS	CON-44	⚡		SCH
1	EA	POWER SUPPLY	(BY SECURITY CONTRACTOR)	⚡		
2	EA	ACCESS CONTROL	(BY SECURITY CONTRACTOR)	⚡		
2	EA	DOOR CONTACT	679-05	⚡	BLK	SCE

DOORS MAY BE HELD-OPEN ELECTRONICALLY. UPON ACTIVATION OF THE BUILDING FIRE ALARM SYSTEM, THE DOORS WILL CLOSE AND POSITIVELY LATCH.

PRESENTING AN AUTHORIZED CREDENTIAL WILL UNLOCK THE LEVER TO ALLOW PASSAGE THROUGH THE OPENING. AN AUTHORIZED CREDENTIAL IS REQUIRED ON EACH SIDE OF THE OPENING.

COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE USER, THE ARCHITECT AND ALL RELATED TRADES.

Hardware Group No. 18

H122.B H122.C

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224HD EPT		628	IVE
2	EA	POWER TRANSFER	EPT10		⚡ 689	VON
2	EA	TWO PT EU MORT LOCK	LM9295EUFBD 03A CON 12/24 VDC		⚡ 626	SCH
2	EA	FIRE/LIFE HOLDER	4040SEH 24V/120V AC/DC AS REQ		⚡ 689	LCN
2	EA	H-SEC SURFACE CLOSER	4211 AVB CUSH		689	LCN
2	EA	ARMOR PLATE	8400 36" X 1" LDW B-CS		630	IVE
2	EA	WIRE HARNESS	CON-44		⚡	SCH
1	EA	POWER SUPPLY	(BY SECURITY CONTRACTOR)			
2	EA	ACCESS CONTROL	(BY SECURITY CONTRACTOR)		⚡	
2	EA	DOOR CONTACT	679-05		⚡ BLK	SCE

DOORS MAY BE HELD-OPEN ELECTRONICALLY. UPON ACTIVATION OF THE BUILDING FIRE ALARM SYSTEM, THE DOORS WILL CLOSE AND POSITIVELY LATCH.

PRESENTING AN AUTHORIZED CREDENTIAL WILL UNLOCK THE LEVER TO ALLOW PASSAGE THROUGH THE OPENING. AN AUTHORIZED CREDENTIAL IS REQUIRED ON EACH SIDE OF THE OPENING.

COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE USER, THE ARCHITECT AND ALL RELATED TRADES.

Hardware Group No. 19

H122.D

EACH TO HAVE:






QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112HD EPT		628	IVE
1	EA	POWER TRANSFER	EPT10		⚡ 689	VON
1	EA	EU MORTISE LOCK	L9095BDEU 03A RX CON 12/24 VDC		⚡ 626	SCH
1	EA	H-SEC SURFACE CLOSER	4211 AVB CUSH		689	LCN
1	SET	WEATHER SEAL	(BY DOOR & FRAME MFR)			
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	656A-V3-223		A	ZER
1	EA	POWER SUPPLY	(BY SECURITY CONTRACTOR)			
2	EA	KEYPAD	(BY SECURITY CONTRACTOR)		⚡	
1	EA	DOOR CONTACT	679-05		⚡ BLK	SCE

PRESENTING AN AUTHORIZED PIN WILL UNLOCK THE LEVER TO ALLOW PASSAGE THROUGH THE OPENING. AN AUTHORIZED PIN IS REQUIRED ON EACH SIDE OF THE OPENING.

COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE USER, THE ARCHITECT AND ALL RELATED TRADES.








Hardware Group No. 20  
 H129.A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224HD		628	IVE
1	EA	CLASSROOM LOCK	L9070BDC 03A		626	SCH
1	EA	ARMOR PLATE	8400 36" X 1 1/2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS447		626	IVE
1	EA	GASKETING	488SBK PSA ZAG		BK	ZER

Hardware Group No. 21  
 H130.A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224HD EPT SECWDHM		628	IVE
1	EA	ANTILIGATURE TIP	TIPIT		628	SEL
1	EA	POWER TRANSFER	EPT10		⚡ 689	VON
1	EA	EU MORTISE LOCK	L9095BDEU HSLR 09-663 RX LX CON 12/24 VDC		⚡ 630	SCH
1	EA	H-SEC SURFACE CLOSER	4211T AVB		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS TKTX		630	IVE
1	EA	WALL STOP	KG183		BLK	KIN
1	EA	GASKETING	488SBK PSA ZAG		BK	ZER
2	EA	ACCESS CONTROL	(BY SECURITY CONTRACTOR)		⚡	
1	EA	POWER SUPPLY	PS902 900-4RL-FA 120/240 VAC		⚡	VON

PRESENTING AN AUTHORIZED CREDENTIAL WILL UNLOCK THE LEVER AND ALLOW PASSAGE THROUGH THE OPENING. A VALID CREDENTIAL IS REQUIRED ON EACH SIDE OF THE OPENING.






COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE USER, THE ARCHITECT AND ALL RELATED TRADES.

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Hardware Group No. 22  
 H130.C

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224HD SEC		628	IVE
1	EA	ANTILIGATURE TIP	TIPIT		628	SEL
1	EA	CLASSROOM LOCK	L9070BDC HSLR 09-663		630	SCH
1	EA	H-SEC SURFACE CLOSER	4511T AVB		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS TKTX		630	IVE
1	EA	MAGNETIC HOLDER	2400LR		689	ABH
1	EA	GASKETING	488SBK PSA ZAG		BK	ZER

DOORS MAY BE HELD-OPEN ELECTRONICALLY. UPON ACTIVATION OF THE BUILDING FIRE ALARM SYSTEM, THE DOORS WILL CLOSE AND POSITIVELY LATCH. COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT AND ALL RELATED TRADES.

END OF SECTION

## SECTION 088000 - GLAZING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section includes:

1. Glass for windows, doors, interior borrowed lites and storefront framing.
2. Glazing sealants and accessories.

#### 1.2 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

- C. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square.

- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Preconstruction adhesion and compatibility test report.

#### 1.5 QUALITY ASSURANCE

- A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

## 1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
  - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

## 1.7 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
  - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
  - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Guardian Glass; SunGuard.
  - 2. Vitro.
  - 3. Insulgard Security Products



## 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the International Building Code and ASTM E 1300.
  - 1. Design Wind Pressures: As indicated on Drawings.
  - 2. Design Snow Loads: As indicated on Drawings.
  - 3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
  - 1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
  - 2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
  - 3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

## 2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
  - 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
  - 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
  - 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

## 2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- C. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

## 2.5 LAMINATED GLASS

- A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
  - 1. Construction: Laminate glass with polyvinyl butyral interlayer or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written instructions.
  - 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
  - 3. Interlayer Color: Clear unless otherwise indicated.

## 2.6 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
  - 1. Sealing System: Dual seals.
  - 2. Perimeter Spacer: Manufacturer's standard warm-edge spacer material and construction.

## 2.7 SECURITY GLAZING

- A. Glass Clad Polycarbonate: ANSI Z97.1.
  - 1. Construction: symmetrical laminated glass clad polycarbonate with heat strengthened or chemically strengthened glass on both exposed surfaces.
  - 2. Shall be laminated glass clad polycarbonate, 7/16 inch  $\pm$  overall thickness, consisting of 1/8 inch chemically strengthened or tempered glass; 1/8 inch polycarbonate core;

and 1/8 inch chemically strengthen or tempered glass with (2) layers of special interlayer material.

## 2.8 GLAZING SEALANTS

### A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Sealant shall have a VOC content of 250 g/L or less.
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

### B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.

#### 1. Available Products:

- a. GE Silicones; Silglaze II SCS2800
- b. Tremco; Tremsil 600
- c. Dow Corning Corporation; 795

### C. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

## 2.9 GLAZING TAPES

### A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

### B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.

2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

## 2.10 MISCELLANEOUS GLAZING MATERIALS

- A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- B. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- C. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- E. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- F. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

## PART 3 - EXECUTION

### 3.1 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

### 3.2 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tape to heads and sills first, then to jambs. Cover horizontal framing joints by applying tape to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Apply heel bead of elastomeric sealant.
- F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- G. Apply cap bead of elastomeric sealant over exposed edge of tape.

### 3.3 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

### 3.4 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### 3.5 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
  - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.

### 3.6 MONOLITHIC GLASS SCHEDULE

- A. Glass Type GL-1: Clear fully tempered float glass at all interior non-fire rated location in all non-patient areas.
  - 1. Minimum Thickness: 6 mm.
  - 2. Safety glazing required.

### 3.7 SECURITY MONOLITHIC GLASS SCHEDULE

- A. Glass Type GL-2: Clear Force Protect Sure-Gard ICGCP716 Glass Clad Polycarbonate at all interior non-fire rated locations in all patient areas, except as noted.
  - 1. Minimum Thickness: 6 mm.
  - 2. Safety glazing required.

### 3.8 INSULATING-LAMINATED-GLASS SCHEDULE

- A. Glass Type GL-3: Low-E-coated, clear insulating laminated glass at exterior doors and exterior windows in non-patient areas.

1. Basis-of-Design Product, provide one of the following:
  - a. Guardian Glass; SunGuard SNX 62/27
  - b. Vitro (PPG); Solarban 70 XL
2. Overall Unit Thickness: 1 inch (25 mm).
3. Outdoor Lite: Clear laminated glass with two plies of tempered float glass.
  - a. Minimum Thickness of Each Glass Ply: 3 mm.
4. Interspace Content: Argon.
5. Indoor Lite: Fully tempered float glass.
6. Minimum Thickness of Indoor Lite: 6 mm.
7. Low-E Coating: Sputtered on third surface.
8. Winter Nighttime U-Factor: .24 maximum.
9. Summer Daytime U-Factor: .21 maximum.
10. Visible Light Transmittance: 61 percent minimum.
11. Solar Heat Gain Coefficient: .27 maximum.
12. Safety glazing required.

### 3.9 SECURITY INSULATING-LAMINATED-GLASS SCHEDULE

- A. Glass Type GL-4: Low-E-coated, clear insulated security laminated glass at all exterior doors, and exterior windows in patient areas.
1. Overall Unit Thickness: 1 inch (25 mm).
  2. Outdoor Lite:
    - a. Basis-of-Design Product, provide one of the following:
      - 1) Guardian Glass; SunGuard SNX 62/27
      - 2) Vitro (PPG); Solarban 70 XL
  3. Interspace Content: Argon.
  4. Indoor Lite:
    - a. Force Protect Sure-Gard ICGCP716 Glass Clad Polycarbonate
  5. Minimum Thickness of Indoor Lite: 6 mm.
  6. Low-E Coating: Sputtered on third surface.
  7. Winter Nighttime U-Factor: .24 maximum.
  8. Summer Daytime U-Factor: .21 maximum.
  9. Visible Light Transmittance: 61 percent minimum.
  10. Solar Heat Gain Coefficient: .27 maximum.
  11. Safety glazing required.

END OF SECTION 088000

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 07 Section "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.
  - 2. Division 20 Section "Basic Mechanical Materials and Methods" for welding requirements.
  - 3. Division 21, 22, and 23 Sections for louvers that are a part of mechanical equipment.

1.2 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.



- B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

### 1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide louvers capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act on vertical projection of louvers.
  - 1. Wind Loads: Determine loads based on pressures as indicated on Structural Drawings.
- B. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- C. Air-Performance, Water-Penetration, Air-Leakage, and Wind-Driven Rain Ratings: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

### 1.5 INFORMATIONAL SUBMITTALS

- A. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other Work. Show blade profiles, angles, and spacing.

### 1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Louvers:
    - a. American Warming and Ventilating, Inc.
    - b. Arrow United Industries.
    - c. Greenheck.
    - d. NCA Manufacturing, Inc.
    - e. Ruskin Company; Tomkins PLC.
  - 2. Wall Vents (Brick Vents):
    - a. Arrow United Industries.
    - b. Greenheck.
    - c. Ruskin Company; Tomkins PLC.

2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Aluminum Castings: ASTM B 26/B 26M, alloy 319.
- D. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.
  - 1. Use types and sizes to suit unit installation conditions.
  - 2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.
- E. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

### 2.3 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
  - 1. Frame Type: Exterior flange, unless otherwise indicated.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less.
  - 1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
- F. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

### 2.4 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Drainable-Blade Louver:
  - 1. Louver Depth: 6 inches.
  - 2. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.100 inch for blades and 0.120 inch for frames.
  - 3. Mullion Type: Exposed.
  - 4. Performance Requirements:
    - a. Free Area: Not less than 7.0 sq. ft. for 48-inch- wide by 48-inch- high louver.
    - b. Point of Beginning Water Penetration: Not less than 1050 fpm.
    - c. Air Performance: Not more than 0.10-inch wg static pressure drop at 800-fpm free-area velocity.
  - 5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

### 2.5 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
  - 1. Screen Location for Fixed Louvers: Interior face.
  - 2. Screening Type: Insect screening.

- B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
  - 1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
  - 2. Finish: Mill finish, unless otherwise indicated.
  - 3. Type: Rewirable frames with a driven spline or insert for securing screen mesh.
- D. Louver Screening for Aluminum Louvers:
  - 1. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

## 2.6 BLANK-OFF PANELS

- A. Uninsulated, Blank-off Panels:
  - 1. Aluminum sheet for aluminum louvers, not less than 0.050-inch nominal thickness, unless otherwise indicated.
  - 2. Panel Finish: Same type of finish applied to louvers, but black color.
  - 3. Attach blank-off panels to back of louver frames with stainless-steel, sheet metal screws.
- B. Insulated, Blank-off Panels: Laminated metal-faced panels consisting of insulating core surfaced on back and front with metal sheets.
  - 1. Thickness: 2 inches.
  - 2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
  - 3. Insulating Core: Unfaced mineral wool or glass-fiber, or flexible elastomeric insulation.
  - 4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than 0.080-inch nominal thickness, with corners mitered and with same finish as panels.
  - 5. Seal perimeter joints between panel faces and louver frames with 1/8-by-1-inch PVC compression gaskets.
  - 6. Panel Finish: Same type of finish applied to louvers, but black color.
  - 7. Attach blank-off panels to back of louver frames with stainless-steel, sheet metal screws.

## 2.7 WALL VENTS (BRICK VENTS)

- A. Extruded-Aluminum Wall Vents: Extruded-aluminum louvers and frames, not less than 0.125-inch nominal thickness, assembled by welding; with 18-by-14- mesh, aluminum insect screening on inside face; incorporating weep holes, continuous drip at sill, and integral waterstop on inside edge of sill; of load-bearing design and construction.

## 2.8 ACCESSORIES

- A. Extended Sill:
  - 1. Material: Extruded aluminum 0.081 inch thick
  - 2. Finish: Same as louvers.

## 2.9 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Factory finish louvers after assembly.

## 2.10 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
- B. High-Performance Organic-Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Fluoropolymer Three-Coat Coating System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
    - a. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

### 3.3 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

### 3.4 ADJUSTING AND CLEANING

- A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

END OF SECTION 089000

## SECTION 092216 - NON-STRUCTURAL METAL FRAMING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.

#### 1.2 ACTION SUBMITTALS

##### A. Product Data: For each type of product.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.
- B. Evaluation reports for firestop tracks, post-installed anchors and power-actuated fasteners.

#### 1.4 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

#### 2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

- B. Steel Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners of equivalent minimum base-metal thickness.
  - 1. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).
  - 2. Depth: As indicated on Drawings.
  
- C. Slip-Type Head Joints: Where indicated, provide one of the following in thickness not less than indicated for studs and in width to accommodate depth of studs:
  - 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (51-mm-) deep flanges, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
  - 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (51-mm-) deep flanges and fastened to studs, and outer runner sized to friction fit inside runner.
  - 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes due to deflection of structure above.
  
- D. Firestop Tracks: Manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
  
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  - 1. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm).
  
- F. Cold-Rolled Channel Bridging: Steel, 0.053-inch (1.34-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
  - 1. Depth: 1-1/2 inches (38 mm).
  - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.
  
- G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm).
  - 2. Depth: As indicated on Drawings.
  
- H. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
  - 1. Configuration: Asymmetrical or hat shaped.
  
- I. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
  - 1. Depth: 3/4 inch (19 mm).
  - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch (0.8 mm).
  - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.



- J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22 mm), minimum uncoated-metal thickness of 0.018 inch (0.45 mm), and depth required to fit insulation thickness indicated.

## 2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.
- B. Hanger Attachments to Concrete:
  - 1. Anchors: Capable of sustaining a load equal to 5 times that imposed as determined by ASTM E 488.
    - a. Type: Postinstalled, chemical anchor or Postinstalled, expansion anchor.
  - 2. Powder-Actuated Fasteners: Capable of sustaining, a load equal to 10 times that imposed as determined by ASTM E 1190.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch (1.34 mm) and minimum 1/2-inch- (13-mm-) wide flanges.
  - 1. Depth: 2 inches (51 mm).
- E. Furring Channels (Furring Members):
  - 1. Cold-Rolled Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
  - 2. Steel Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners of equivalent minimum base-metal thickness.
    - a. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm).
    - b. Depth: 1-5/8 inches (41 mm).
  - 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.
    - a. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm).
  - 4. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.
    - a. Configuration: Asymmetrical or hat shaped.

## 2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
  1. Asphalt-Saturated Organic Felt: ASTM D 226/D 226M, Type I (No. 15 asphalt felt), nonperforated.
  2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
  1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
  2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
  3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
  4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

#### 3.2 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to

terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
    - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
  5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
  6. Curved Partitions:
    - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches (150 mm) o.c.
- E. Direct Furring:
1. Screw to wood framing.
  2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
- F. Z-Shaped Furring Members:
1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches (610 mm) o.c.
  2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
  3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of

furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (305 mm) from corner and cut insulation to fit.

- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

### 3.3 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
  - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  - 5. Do not attach hangers to steel roof deck.
  - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  - 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

## SECTION 092900 - GYPSUM BOARD

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Interior gypsum board.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

#### 2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

#### 2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. CertainTeed Corp.
  - 2. Georgia-Pacific Gypsum LLC.
  - 3. National Gypsum Company.
  - 4. USG Corporation.
- B. Gypsum Board: ASTM C 1396/C 1396M.
  - 1. Thickness: 5/8 inch (15.9 mm).
  - 2. Long Edges: Tapered.
- C. Gypsum Board, Type X: ASTM C 1396/C 1396M.
  - 1. Thickness: 5/8 inch (15.9 mm).
  - 2. Long Edges: Tapered.
- D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
  - 1. Thickness: 5/8 inch (15.9 mm).
  - 2. Long Edges: Tapered.

#### 2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
  - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.

## 2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  - 1. Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

## 2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing).
- E. Acoustical Joint Sealant: ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings as demonstrated by testing according to ASTM E 90.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
    - b. Grabber Construction Products; Acoustical Sealant GSC.
    - c. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
    - d. USG Corporation; SHEETROCK Acoustical Sealant.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- G. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- H. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- I. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

### 3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
  - 1. Wallboard Type: Vertical surfaces unless otherwise indicated.
  - 2. Type X: Where required for fire-resistance-rated assembly.
  - 3. Ceiling Type: Ceiling surfaces.
  - 4. Type C: Where required for specific fire-resistance-rated assembly indicated.
- B. Single-Layer Application:
  - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
  - 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
  - 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
  - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

### 3.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners unless otherwise indicated.
  - 2. LC-Bead: Use at exposed panel edges.

### 3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 4: Ceiling surfaces inside storage rooms and janitors closet.
  - 3. Level 5: At panel surfaces that will be exposed to view.
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

### 3.6 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900



## SECTION 093013 - CERAMIC TILING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Porcelain tile.
  2. Crack isolation membrane.
  3. Metal edge strips.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
1. Product Data: For adhesives, indicating VOC content.
  2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
  3. Laboratory Test Reports: For sealers, indicating compliance with requirements for low-emitting materials.
- C. Samples:
1. Each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide samples of each color blend.
  2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required.
  3. Stone thresholds.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

## 1.5 QUALITY ASSURANCE

### A. Installer Qualifications:

1. Installer has done work of similar projects that can be verified upon request.
2. Installer uses best practices as outlined in the TCNA (Tile Council of North America) handbook.

### B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.6 ATTIC STOCK

- ### A. Provide the Owner with 3% attic stock.

## PART 2 - PRODUCTS

### 2.1 PRODUCTS, GENERAL

- #### A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
- #### B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

### 2.2 TILE PRODUCTS

#### A. Ceramic Tile: Porcelain floor tile (**C.TILE**).

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. Stonepeak Ceramics, Inc.
2. Certification: Tile certified by the Porcelain Tile Certification Agency.
3. Face Size: 12 by 24 inches.
4. Thickness: 1/3inch (8 mm).
5. Face: Plain with square edges.
6. Dynamic Coefficient of Friction: Not less than 0.42.
7. Tile Color, Glaze, and Pattern: Simply Tan, Honed finish.
8. Grout Color: Laticrete, color: Hemp 27 or Architect approved match.

- B. Ceramic Tile: Porcelain Coved wall base tile.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Stonepeak Ceramics, Inc.
  - 2. Certification: Tile certified by the Porcelain Tile Certification Agency.
  - 3. Face Size: 6 by 12 inches.
  - 4. Tile Color, Glaze, and Pattern: Simply Tan, Honed finish.
  - 5. Grout Color: Laticrete, color: Hemp 27 or Architect approved match.

### 2.3 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide LATICRETE International, Inc.; Laticrete Fracture Ban SC.

### 2.4 SETTING MATERIALS

- A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide LATICRETE International, Inc; Laticrete 4XLT; or a comparable product by one of the following:
    - a. ARDEX Americas.
    - b. Bonsal American, an Oldcastle company.
    - c. Bostik, Inc.
    - d. H.B. Fuller Construction Products Inc. / TEC.
    - e. MAPEI Corporation.
  - 2. Provide prepackaged, dry-mortar mix to which only water must be added at Project site.
  - 3. For wall applications, provide nonsagging mortar.

### 2.5 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.
- B. High-Performance Tile Grout: ANSI A118.7.
- C. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.

1. Basis-of-Design Product: Subject to compliance with requirements, provide LATICRETE International, Inc.; SpectraLOCK Pro, color: Hemp 27 or a comparable product by one of the following:
  - a. ARDEX Americas.
  - b. Bonsal American, an Oldcastle company.
  - c. Bostik, Inc.
  - d. H.B. Fuller Construction Products Inc. / TEC.
  - e. MAPEI Corporation.

## 2.6 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.
- C. Metal Edge Strips: Provide edge strips and transitions of appropriate heights at all dissimilar flooring abutments.
  1. Edge Strip:
    - a. At areas where ceramic tile abuts floor material of equal height.
    - b. Product: Schluter Systems
      - 1) Series: Schiene
      - 2) Finish: AA - Satin anodized silver aluminum
  2. Small Reducer:
    - a. At areas where ceramic tile abuts floor materials such as LVT.
    - b. Product: Schluter Systems
      - 1) Series: Reno-U
      - 2) Finish: AA - Satin anodized silver aluminum
  3. Medium Reducer:
    - a. At areas where ceramic tile abuts floor materials such as carpet or other materials with minimum 1/4" thickness.
    - b. Product: Schluter Systems
      - 1) Series: Reno-TK
      - 2) Finish: AA - Satin anodized silver aluminum
  4. Large Reducer:
    - a. At areas where ceramic tile abuts concrete floors with no floor coverings.

- b. Product: Schluter Systems
  - 1) Series: Reno-Ramp
  - 2) Finish: AA - Satin anodized silver aluminum

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
  - 2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

#### 3.3 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
  - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

- a. Tile floors in wet areas.
  - b. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
  - c. Tile floors consisting of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
- G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
1. Porcelain Tile: 3/16 inch
- H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them..
- I. Metal Edge Strips: Install at locations indicated.
- J. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

### 3.4 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor: (To be use at first floor applications)
1. Ceramic Tile Installation F125: TCNA F125-Full; thinset mortar on crack isolation membrane.
    - a. Ceramic Tile Type: Porcelain Tile.
    - b. Thinset Mortar: Modified dry-set mortar.
    - c. Grout: Water-cleanable epoxy grout.

B. Interior Wall Installations,:

1. Ceramic Tile Installation W2021-15: TCNA W2021-15; thinset mortar on masonry.
  - a. Ceramic Tile Type: Porcelain Tile.
  - b. Thinset Mortar: Modified dry-set mortar.
  - c. Grout: Water-cleanable epoxy grout.

END OF SECTION 093013

## SECTION 095113 - ACOUSTICAL PANEL CEILINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

#### 1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
  - 1. Product Data: For recycled content, indicating postconsumer and pre-consumer recycled content and cost.
  - 2. Laboratory Test Reports: For ceiling products, indicating compliance with requirements for low-emitting materials.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Delegated-Design Submittal: For seismic restraints for ceiling systems.
  - 1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Research reports.
- C. Field quality-control reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.



## 1.6 ATTIC STOCK

- A. Provide 3% attic stock for SAT-1 and SAT-2, including accompanying metal suspension system.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: Class A according to ASTM E 1264.
  - 2. Smoke-Developed Index: 450 or less.

### 2.2 ACOUSTICAL PANELS

- A. : Manufacturer's standard panels according to ASTM E 1264.
- B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

#### C. SAT-1

- 1. Basis of Design: Armstrong, Style: Fissured #705A
- 2. Color: White
- 3. Light Reflectance (LR): .79
- 4. Ceiling Attenuation Class (CAC): 35
- 5. Noise Reduction Coefficient (NRC): .55
- 6. Edge/Joint Detail: Square Lay-in.
- 7. Thickness: 5/8"
- 8. Modular Size: 24 by 24 inches

#### D. SAT-2

- 1. Basis of Design: Armstrong, Style: Kitchen Zone
- 2. Color: White
- 3. Light Reflectance (LR): .89
- 4. Ceiling Attenuation Class (CAC): 33
- 5. Noise Reduction Coefficient (NRC): N/A
- 6. Edge/Joint Detail: Square Lay-in.
- 7. Thickness: 5/8"
- 8. Modular Size: 24 by 24 inches

### 2.3 METAL SUSPENSION SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Prelude 15/16" Exposed Tee.
- B. Metal Suspension-System Standard: Manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M.

### 2.4 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- B. Hold Down Devices: "Armstrong"\_'Universal Hold Down Clip'- #UHDCA or approved equivalent as compatible with SAT-1 and SAT-2.

### 2.5 METAL EDGE MOLDINGS AND TRIM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc; 7/8 inch Hemmed Angle molding.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated.
- B. Layout openings for penetrations centered on the penetrating items.

### 3.2 INSTALLATION

- A. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
  - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  - 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
  - 3. Arrange directionally patterned acoustical panels as follows:
    - a. As indicated on reflected ceiling plans.

Center For Forensic Psychiatry  
Kitchen  
Michigan Department of Health and Human Services  
Saline, Michigan

File No. 491/20167.SDW  
Index No. 5603  
PSC Project No. 2021094

END OF SECTION 095113

## SECTION 096513 - RESILIENT BASE AND ACCESSORIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Wall base.
  - 2. Resilient transition strips.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product indicated.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

#### 1.5 PROJECT CONDITIONS

- A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After post installation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Install resilient products after other finishing operations, including painting, have been completed.

#### 1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

### PART 2 - PRODUCTS

#### 2.1 RESILIENT WALL BASE (**RWB**):

- A. Wall Base: ASTM F 1861.
  - 1. Johnsonite / Tarkett TP Rubber or Architect approved equal.
- B. Style: Cove
- C. Color: Charcoal #20.

- D. Height: 4 inches.
- E. Thickness: 1/8"
- F. Lengths: Coils in manufacturer's standard length.
- G. Outside Corners: Job formed.
- H. Inside Corners: Job formed.
- I. Surface: Flat with cove bottom.
- J. Locations: all.

## 2.2 RESILIENT TRANSITION STRIPS

- A. Resilient Wheeled Traffic Transitional Mouldings.
  - 1. Johnsonite / Tarkett or Architect approved equal.
- B. Style: Wheeled Traffic PVC style as required for floor material height transitions.
- C. Comply with A.D.A. requirements of Section 4.5.2 Changes of Level.
- D. Color: Charcoal #20.
- E. Lengths: 12 ft.
- F. Locations: at all areas where carpet tile abuts resilient flooring.

## 2.3 INSTALLATION MATERIALS

- A. Adhesives:
  - 1. At Wall Base: Tarkett water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
  - 2. At Transition Strips: Tarkett adhesive type recommended by manufacturer to suit resilient products and substrate conditions indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- C. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- D. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
  - 1. Do not install resilient products until they are the same temperature as the space where they are to be installed.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 INSTALLATION

- A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- D. Do not stretch wall base during installation.
- E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.
- F. Job-Formed Corners:
  - 1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
  - 2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.
- G. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

### 3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing resilient product installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.
    - a. Do not wash surfaces until after time period recommended by manufacturer.
- B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

END OF SECTION 096513

## SECTION 096516 - RESILIENT SHEET FLOORING (RSF)

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. Submittals: Product data and Samples
- B. Samples: For each exposed product and for each color, texture, and pattern specified.

#### 1.2 CLOSEOUT SUBMITTALS

- A. Maintenance data.

#### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.
- B. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

### PART 2 - PRODUCTS

#### 2.1

- A. Basis-of-Design Product - "Protect All"-Heavy Duty Commercial Safety Flooring:- .
- B. Matte Finish
- C. Sheet Size: 5' x 8' x 1/4"
- D. Seamless-Installation Method: Protect-All Rapid Weld in matching color
- E. Cove Base System 6" Protect-All in matching color with stainless steel cove base cap.

#### 2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement- or blended-hydraulic-cement-based formulation provided or approved by flooring manufacturer for applications indicated.

- B. Adhesives: Water-resistant 2-Part Epoxy recommended by manufacturer to suit floor covering and substrate conditions indicated.
- C. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.
- D. Integral-Flash-Cove-Base Accessories: 1-inch- (25.4-mm-) radius cove strip and z-bar stainless steel cap; both provided or approved by floor covering manufacturer.
- E. Integral Stainless Steel Drain trim rings.
- F. Stainless Steel Corner Guards

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Prepare concrete substrates according to ASTM F 710 and manufacturers recommendations. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
- B. Unroll sheet floor coverings and allow them to stabilize a minimum of 24 hours at temperature recommended by manufacturer before cutting and fitting.
- C. Installation area must be enclosed and watertight with all walls, wall finishes, doors and floor penetrations in place.
- D. Assure confinement of space during installation and curing of adhesives to prevent other trades from damaging the product or compromising the adhesion.
- E. Maintain a constant temperature during the installation and throughout the curing of adhesives according to manufacturers recommendations.
- F. Maintain uniformity of resilient sheet flooring direction, and match edges for color shading at seams.
- G. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (152 mm) away from parallel joints in substrates. Follow manufacturer recommendations for laying sheets out.
- H. Install stainless steel drain rings, cove base, corner guards and transitions according to manufacturer's instructions.
- I. Seamless Installation:
  - 1. Chemically Bonded Seams: Bond seams with chemical-bonding compound to permanently fuse sections into a seamless flooring.
- J. Integral Flash Cove Base: Cove floor coverings 6 inches up vertical surfaces.



- K. All exposed edges are to be sealed with manufacturer's recommended sealant.
- L. Execute post-installation cleaning per manufacturer.

END OF SECTION 096516

## SECTION 096519 - RESILIENT TILE FLOORING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Luxury vinyl tile flooring.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
  - 1. Show details of special patterns.
- C. Samples: Full-size units of each color and pattern of floor tile required.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Maintenance data.

#### 1.4 WARRANTY

- A. Warranty Period: Manufacturer's standard warranty against manufacturing defects and wearing for flooring and as follows:
  - 1. 15 year commercial warranty.
  - 2. Lifetime residential warranty.

#### 1.5 EXTRA MATERIALS

- A. Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels.
  - 1. Quantity: Furnish quantity of flooring units equal to 2 percent of amount installed.  
Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra materials.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

#### 2.2 LUXURY VINYL TILE FLOORING (RSF)

- A. Provide the following:
- B. Manufacturer: Tarkett
- C. Style: iD Latitude
- D. Color: Hearthstone

- E. Wear Layer Thickness: 20 mil..
- F. Size: 18"x18".
- G. Edges: square
- H. Installation: Glue-Down

### 2.3 ADHESIVE

- A. Provide Armstrong's recommended adhesive for subfloor conditions.

### 2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
  - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
  - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
    - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

### 3.2 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.

- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
  - 1. Lay tiles square with room axis (LVT-1) or in pattern indicated (LVT-2).
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
  - 1. Lay tiles with grain running in one direction, unless noted on the plan otherwise.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

### 3.3 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Cover floor tile until Substantial Completion.

END OF SECTION 096519

## SECTION 099113 - EXTERIOR PAINTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
  - 1. Steel.
  - 2. Galvanized metal.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples: For each type of paint system and each color and gloss of topcoat.

#### 1.3 MAINTENANCE MATERIALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles for the paint category indicated.

#### 2.2 PAINT, GENERAL

- A. Material Compatibility:
  - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. Colors: As selected by Architect from manufacturer's full range.

#### 2.3 PRIMERS/SEALERS

- A. Primer, Alkyd for Exterior Wood:
  - 1. Manufacturer: Benjamin Moore & Co.
  - 2. Product: Fresh Start Exterior Wood Primer No. 0094.
  - 3. Equal products as manufactured by the following are also acceptable.
    - a. PPG Architectural.
    - b. Pratt & Lambert.
    - c. Sherwin-Williams.

#### 2.4 METAL PRIMERS

- A. Primer, Alkyd, Anti-Corrosive for Metal:
  - 1. Manufacturer: Benjamin Moore & Co.

2. Product: Super Spec HP Alkyd Metal Primer No. P06.
  3. Equal products as manufactured by the following are also acceptable.
    - a. PPG Architectural.
    - b. Pratt & Lambert.
    - c. Sherwin-Williams.
- B. Primer, Galvanized, Water Based:
1. Manufacturer: Benjamin Moore & Co./Coretech High Performance.
  2. Product: Waterborne Bonding Primer No. V175.
  3. Equal products as manufactured by the following are also acceptable.
    - a. PPG Architectural.
    - b. Pratt & Lambert.
    - c. Sherwin-Williams.

## 2.5 SOLVENT-BASED PAINTS

- A. Alkyd, Exterior, Gloss:
1. Manufacturer: Benjamin Moore & Co.
  2. Product: Super Spec Urethane Alkyd Gloss Enamel No. P22.
  3. Equal products as manufactured by the following are also acceptable.
    - a. PPG Architectural.
    - b. Pratt & Lambert.
    - c. Sherwin-Williams.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
  1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations.
- B. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations.
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

### 3.4 CLEANING AND PROTECTION

- A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.5 EXTERIOR PAINTING SCHEDULE

- A. Steel Substrates:
  - 1. Alkyd System:
    - a. Prime Coat: Primer, alkyd, anticorrosive for metal.
    - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
    - c. Topcoat: Alkyd, exterior, gloss (Gloss Level 6).
- B. Galvanized-Metal Substrates:
  - 1. Alkyd System:
    - a. Prime Coat: Primer, galvanized, water based.
    - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
    - c. Topcoat: Alkyd, exterior, gloss (Gloss Level 6).

END OF SECTION 099113

## SECTION 099123 - INTERIOR PAINTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
  - 1. Concrete masonry units (CMUs).
  - 2. Steel and iron.
  - 3. Galvanized metal.
  - 4. Wood.
  - 5. Gypsum board.
  - 6. Acoustical ceiling panels.

#### 1.2 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Sustainable Design Submittals:
  - 1. Product Data: For paints and coatings, indicating VOC content.



2. Laboratory Test Reports: For paints and coatings, indicating compliance with requirements for low-emitting materials.
- C. Samples: For each type of paint system and in each color and gloss of topcoat.

#### 1.4 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
    - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
    - b. Other Items: Architect will designate items or areas required.
  2. Final approval of color selections will be based on mockups.
    - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Benjamin Moore & Co.
  2. Sherwin-Williams Company (The).

#### 2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
  1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
  2. Nonflat Paints and Coatings: 150 g/L.
  3. Dry-Fog Coatings: 400 g/L.
  4. Primers, Sealers, and Undercoaters: 200 g/L.
  5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
  6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
  7. Pretreatment Wash Primers: 420 g/L.
  8. Shellacs, Clear: 730 g/L.
  9. Shellacs, Pigmented: 550 g/L.
- D. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. Colors to match Sherwin Williams:
1. WALLS - SW1102 CHENEILLE WHITE
  2. CEILINGS - SW1004 PURE WHITE
  3. DOORS AND FRAMES - SW1099 KNUBBY WOOL
  4. STAIRS AND RAILINGS - HC-124 CALDWELL GREEN

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Masonry (Clay and CMUs): 12 percent.
  2. Wood: 15 percent.
  3. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

### 3.4 INTERIOR PAINTING SCHEDULE

#### A. CMU Substrates:

- 1. Latex System MPI INT 4.2A:
  - a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
    - 1) Benjamin Moore: Super Spec Masonry Interior/Exterior Hi-Build Block Filler 0206.
    - 2) S-W PrepRite Block Filler, B25W25.
  - b. Intermediate Coat: Latex, interior, matching topcoat.
  - c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.
    - 1) Benjamin Moore: Ultra Spec 500 Zero VOC Interior Gloss Finish N540.
    - 2) S-W ProMar 200 Latex Gloss, B11-2200 Series.

#### B. Steel Substrates:

- 1. Institutional Low-Odor/VOC Latex System MPI INT 5.1S:
  - a. Prime Coat: Primer, rust inhibitive, water based MPI #107.
    - 1) Benjamin Moore: Super Spec HP D.T.M. Acrylic Low Lustre P25.
    - 2) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series.
  - b. Topcoats: Latex, interior, institutional low odor/VOC (MPI Gloss Level 5), MPI #147.
    - 1) Benjamin Moore: Ultra Spec 500 Zero VOC Interior Low Sheen Finish N537.
    - 2) S-W Pro Industrial Acrylic Gloss Coating, B66-660 Series.

2. Water-Based Dry-Fall System:
  - a. Ensure all bare surfaces are appropriately primed per paint manufacturers recommendations.
  - b. Top Coat: Dry-fall latex, flat, MPI #118:
    - 1) Benjamin Moore: CoronadoSuper Kote 5000 Latex Flat Dry Fall N110, at 5.0 mils wet, 2.0 mils dry.
    - 2) S-W Pro Industrial Waterborne Acrylic Dryfall Flat, B42-80 Series, at 6.0 mils wet, 1.7 mils dry.
  
- C. Wood Substrates: Wood trim.
  1. Latex over Alkyd Primer System MPI INT 6.3U:
    - a. Prime Coat: Primer sealer, alkyd, interior, MPI #45.
      - 1) Benjamin Moore: Super Spec Alkyd Enamel Undercoater & Primer Sealer C245
      - 2) S-W PrepRite ProBlock Primer Sealer, B51-620 Series
    - b. Intermediate Coat: Latex, interior, matching topcoat.
    - c. Topcoat: Latex, interior (MPI Gloss Level 3), MPI #52.
      - 1) Benjamin Moore: Ultra Spec 500 Zero VOC Interior Eggshell Finish N538.
      - 2) S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series
  
- D. Gypsum Board Substrates:
  1. Latex over Latex Sealer System MPI INT 9.2A:
    - a. Prime Coat: Prime Coat: Primer sealer, latex, interior , MPI #50.
      - 1) Benjamin Moore: Ultra Spec 500 Zero VOC Interior Latex Primer N534
      - 2) S-W ProMar 200 Zero VOC Latex Primer, B28W2600
    - b. Intermediate Coat: Latex, interior, matching topcoat.
    - c. Topcoat: Latex, interior, eggshell (MPI Gloss Level 3), MPI #52.
      - 1) Benjamin Moore: Ultra Spec 500 Zero VOC Interior Eggshell Finish N538
      - 2) S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series
  
- E. Acoustical Ceiling Panels:
  1. Water-Based Dry-Fall System:
    - a. Top Coat: Dry-fall latex, flat, MPI #118:
      - 1) Benjamin Moore: CoronadoSuper Kote 5000 Latex Flat Dry Fall N110, at 5.0 mils wet, 2.0 mils dry.
      - 2) S-W Pro Industrial Waterborne Acrylic Dryfall Flat, B42-80 Series, at 6.0 mils wet, 1.7 mils dry.

F. Steel Railings:

1. High Performance Polyurethane Coating:

a. Prime Coat: Institutional low odor/VOC

1) S-W Macropoxy 646 Fast Cure Epoxy.

b. Intermediate Coat: Polyurethane, matching topcoat.

c. Topcoats: Polyurethane, Institutional low odor/VOC (MPI Gloss Level 6).

1) S-W Hi-Solids Polyurethane.

END OF SECTION 099123

## SECTION 102800 - TOILET ROOM AND CUSTODIAL ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Single occupancy toilet room accessories.
  - 2. Custodial accessories.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: Full size, for each exposed product and for each finish specified.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

#### 1.5 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 15 years from date of Substantial Completion.
- B. Special Automatic Soap Dispenser Warranty: Manufacturer's standard form in which manufacturer agrees to replace soap dispensers that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Lifetime.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.2 MANUFACTURER

- A. Products listed are based on those of Bobrick. Equal products from Bradley or American Specialties (ASI) will be accepted. Provide products from a single manufacturer to the maximum extent possible.

## 2.3 SINGLE OCCUPANCY TOILET ROOM ACCESSORIES

- A. Toilet Tissue (Roll) Dispenser: (Owner furnished, contractor installed)

1. Basis-of-Design Product: Bobrick; B-2888, Surface-Mounted Multi-Roll Toilet tissue Dispenser.
2. Description: Double-roll dispenser.
3. Mounting: Surface mounted.
4. Operation: Noncontrol delivery with theft-resistant spindle.
5. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
6. Material and Finish: Stainless steel, No. 4 finish (satin).

- B. Paper Towel (Folded) Dispenser: (Owner furnished, contractor installed)

1. Basis-of-Design Product: Bobrick; B262, Surface-Mounted Paper Towel Dispenser.
2. Mounting: Surface mounted.
3. Minimum Capacity: 400 C-fold or 525 multifold towels.
4. Material and Finish: Stainless steel, No. 4 finish (satin).
5. Lockset: Tumbler type.
6. Refill Indicators: Pierced slots at sides or front.

- C. Liquid-Soap Dispenser: (Owner furnished, contractor installed)

1. Basis-of-Design Product: Bobrick; B-4112, Surface-Mounted Liquid Soap Dispenser.
2. Description: Designed for dispensing soap in liquid or lotion form.
3. Mounting: Surface mounted.
4. Capacity: 40-fl oz. (1.0-L).
5. Materials: Chrome plated.

- D. Grab Bar:

1. Basis-of-Design Product: Bobrick; B-6806, Straight Grab Bar.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
  - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches (38 mm).
5. Configuration and Length: As indicated on Drawings.

- E. Mirror Unit:

1. Basis-of-Design Product: Bobrick; product B-165 1836.
2. Frame: Stainless-steel angle, 0.05 inch (1.3 mm) thick.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

- a. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
- b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

F. Sanitary-Napkin Disposal Unit:

1. Basis-of-Design Product: Bobrick; B-254, Surface-Mounted Sanitary Napkin Disposal.
2. Mounting: Surface mounted.
3. Door or Cover: Self-closing, disposal-opening cover.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, No. 4 finish (satin) with stippled finish on tray.

2.4 CUSTODIAL ACCESSORIES

A. Mop and Broom Holder:

1. Basis-of-Design Product: Bobrick; B-224 x 36 .
  2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
  3. Length: 36 inches (914 mm).
  4. Hooks: Three.
  5. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
  6. Material and Finish: Stainless steel, No. 4 finish (satin).
- a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.
  - b. Rod: Approximately 1/4-inch- (6-mm-) diameter stainless steel.

2.5 FABRICATION

- A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

END OF SECTION 102800



## SECTION 104413 - FIRE PROTECTION CABINETS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes fire-protection cabinets for portable fire extinguishers.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For fire-protection cabinets.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Maintenance data.

#### 1.4 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

#### 2.2 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. J.L. Industries, Inc., a division of Activar Construction Products Group.
    - b. Larsen's Manufacturing Company.
    - c. Potter Roemer LLC.
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Cold-rolled steel sheet.
- D. Semi-Recessed Cabinet.
  - 1. Provide a semi-recessed cabinet. Door shall be solid panel, with 2 inch wide steel frame and having a continuous hinge. Cabinets shall be 18 gauge steel box with flat edge trim. Cabinet interior finish to be baked white enamel. Exterior finish of doors and trim shall be given a factory applied prime coating forming a paintable base for field applied enamel finish. Doors to have red vertical die cut lettering in satin finish. Larson "Occult Series" is basis of design.
- E. Recessed Detention Cabinet.
  - 1. Provide a recessed cabinet. Door shall be solid panel, with 2 inch wide steel frame and having a continuous hinge. Cabinet interior finish to be baked white enamel. Exterior finish of doors and trim shall be given a factory applied prime coating forming a

paintable base for field applied enamel finish. Doors to have red vertical die cut lettering in satin finish. Provide security features found in Larson "DEC 2712 Series" which is basis of design.

- F. Cabinet Trim Material: Steel sheet.
- G. Door Material: Steel sheet.
- H. Door Style: Fully glazed panel with frame.
- I. Door Glazing: Tempered float glass (clear).
- J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
- K. Materials:
  - 1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
    - a. Finish: Baked enamel or powder coat.
    - b. Color: As selected by Architect from full range of industry colors and color densities.
  - 2. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

## 2.3 ACCESSORIES

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or backed-enamel finish.
- B. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as indicated by Architects.
  - 1. Identify fire extinguisher in cabinet with the words "FIRE EXTINGUISHER" applied to door.
    - a. Application Process: Vinyl letters.
    - b. Lettering Color: Red.
    - c. Orientation: Horizontal.

## 2.4 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.
- B. Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- C. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
- D. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

END OF SECTION 104413

## SECTION 104416 - FIRE EXTINGUISHERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and lockable detention style fire extinguisher cabinets

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

#### 1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

#### 1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: Six years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

## 2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. JL Industries, Inc.; a division of the Activar Construction Products Group.
    - b. Larsens Manufacturing Company.
    - c. Potter Roemer LLC.
  - 2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical UL-rated Type 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Examine fire extinguishers for proper charging and tagging.
  - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
  - 1. Mounting Brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

## SECTION 114000 - FOOD SERVICE EQUIPMENT

### 1. GENERAL:

- A. Furnish and install all items of apparatus, equipment, materials, and accessories. Indicated on Plans.
- B. Furnish and install all items of equipment and materials, which are basically requisite. To the installation of complete and satisfactory operating systems.
- C. The intent of the specifications is to outline or indicate work, or both that cannot be readily shown on the drawings, and to indicate types and qualities of materials. The only exclusions are those marked on drawings generally as "Not in Contract", N.I.C., or as designated by other Contractor or by Owner
- D. Divisions into chapters and paragraphs are for convenience only. Contractor shall assign work to proper personnel.
- E. Specification by reference. When reference is made to specifications of a Manufacturer, trade association, or similar source, such is made a part of these specifications and have the same force and effect as though reproduced herein, and on entering into a Contract, each Contractor acknowledges his familiarity with those pertaining to his work.
- F. Computed dimensions take precedence over scaled dimensions and larger scale drawings over smaller.
- G. Should the drawings disagree with themselves or with the specifications the better quality or greater quantity of work or materials shall be estimated upon and unless otherwise directed by the Architect or Owner shall be provided.

### 2. General Requirements

- A. All items of equipment shall be delivered to site, assembled, attached, and set in place at the building during regular working hours unless time schedule requirements necessitate otherwise, complete in every detail in accordance with the drawings and specifications ready to receive final connections by others. All items specified as manufacturers' standards shall include accessories as provided under manufacturers' descriptions. Where options are specified, they shall be manufacturers' standard modifications or accessories.
- B. Work under this Contract shall include installation of Canopy and/or hood specified before ceiling finish has been applied.
- C. The K.E.C. will be responsible for the complete and satisfactory accomplishment of all work bearing on his trade. All crating and refuse involved in this work shall be disposed of by this Contractor. All equipment shall be in perfect condition, thoroughly cleaned, tested, oiled and adjusted at the time of turning over to Owner for his acceptance.

- D. The K.E.C. shall make arrangements at his own expense for receipt of and placing in storage area all shipments, with the General Contractor. Such shipments must be prepaid as there are no local funds available to pay transportation or other charges.
- E. All items of equipment for which national Sanitation Foundation has prescribed standards of construction must be constructed to conform with current standards and bear the N.S.F., U.L., A.S.M.E., and A.G.A. Seals of approval.
- F. The Base Proposal submitted under this Division of work shall be based on the materials and equipment of the manufacturers' makes, sizes and types specified. Alternate Proposal to be made separately on letterhead for equipment that will conform with the plan and specifications showing cost differential of each item including cost of any required changes in mechanical work if alternated items are accepted. Final decision for acceptance or rejection of alternate items shall be at the discretion of the Architect and/or Owner.
- G. K.E.C. shall provide to the Plumbing, Electrical and General Contractors, scale piping, wiring, floor plans, pit and curb base rough-in, required number of bound brochures of all manufacturers' standard items, indicating H.P., Voltage, Phase, pipe connecting, sizes, B.T.U. ratings, etc., and/or other pertinent information which will assist other Contractors.
- H. At the completion of installation, K.E.C. will provide the Owner with operations manuals for the operation and maintenance of each piece of equipment in addition to providing a trained Kitchen Equipment Instructor to demonstrate proper use of equipment to designated personnel.
- I. Not less than thirty (30) days nor more than sixty (60) days after Kitchen Equipment is in operation, a complete inspection of the installation to be made by qualified Kitchen Equipment Service Personnel, making any necessary repairs or adjustments with written report to Owner.
- J. K.E.C. will supply to respective contractors all sink faucets, solenoid valves, siphon breakers, mounting adaptors, switches, controls, thermostats, and/or other parts, fittings, and devices not an attached integral part of Manufacturers' equipment for Installation as requested.
- K. Equipment must conform to building lines and be fitted neatly around obstructions, pipes, columns. Dimensions given are approximate on drawings and must be verified either bolted or field welded by K.E.C. on job site.
- L. All fabricated equipment to be manufactured by one recognized and approved manufacturer of high quality Food Service Equipment for a period of ten (10) years having the experience, personnel and plan facilities to insure uniformity of product and approval of Local, State, and National Health & Dietary Authorities.
- M. Any electrical disconnect switches and manual motor starters required by Code will be furnished and installed by Electrical Contractor. Electrical Contractor will wire from disconnect switch or starter to outlet box on equipment. All electrical accessories except for the above disconnect switches and manual starters will be

furnished by equipment manufacturer. Equipment will be pre-wired from outlet box to magnetic starters and to other points. All motors 1/2 H.P. and larger shall be 120/240/460 volt, 1 or 3 phase. Unless otherwise noted, motors 1/3 H.P. and smaller shall be 120 volt, single phase. Cords and plugs when not furnished as manufacturers' standards, shall be provided by electrical contractor.

3. Related Work by Others

- A. In general, all utility rough-ins and final connections, as well as certain other special work which is listed hereinafter, will be performed by others in accordance with the following detailed requirements.
- B. The K.E.C. shall furnish the installing trades with all information and assistance required for the proper installation of all equipment and/or components.
- C. The work to be done by the Electrical Contractor relating to equipment in this section, unless noted otherwise on the drawings, shall include, but not be limited to, the following:
  - 1. General
    - a. Rough-in electrical service thru walls, floors and/or ceiling and run conduit and conductors from the rough in and make the connections to an approved terminal block, terminal panel or junction box on the equipment as furnished by the K.E.C. The K.E.C. to coordinate the work so as to make all final connections accessible.
    - b. Furnish and install all electrical outlets in walls, floor, and ceiling. Where plug-in receptacles are shown, the K.E.C. shall be responsible for all work beyond the receptacle.
    - c. Furnish and install disconnect switches as required for the equipment in accordance with the electrical code.
    - d. Furnish and install all conduit and conductors between remote control panels and equipment.
  - 2. Disposer
    - a. Wire from rough-in thru the disposer control panel and/or components to disposer motor.
  - 3. Fire control System
    - a. Furnish and install shunt trips and/or power contactors with 120 volt coils with contact ratings matching the cooking appliances under the range hood ventilator. Wire from the micro-switch/relay on the fire control system chemical tanks to the power contactors/shunt trips.
    - b. Wire from the micro-switch/relay on the fire control chemical tanks to the electrically operated automatic gas shut-off valve and reset station.

4. Walk-in cooler/Freezer
  - a. Wire from the timer mounted on compressor rack to the low temperature unit cooler coil mounted in the freezer compartment all as furnished by the K.E.C.
  - b. Wire from junction box on unit cooler coils to room temperature thermostats and solenoid valve all as furnished by the K.E. C.
  - c. Wire from the pre-wired lights and switch assembly to the additional ceiling lights all as furnished by the K.E.C.
  - d. Wire from the junction box on top of the cooler/freezer ceiling to the unit cooler coils all as furnished by the K.E.C.
- D. The work to be performed by the Mechanical Contractor and/or Plumbing Contractor relating to equipment in this section, unless noted otherwise on the drawings, shall include, but not be limited to, the following:
  1. General
    - a. Rough-in waste, steam, gas and water lines thru the walls, floors and ceilings as shown on the drawings. Run waste lines from the rough-in and make the final connections on the equipment. Provide all traps and manifold and interconnect sink drains where shown. Run supply lines from the rough-in and make the connections to the equipment. Provide all traps, strainers, valves, and vents required for proper installation.
    - b. Rough-in exhaust systems thru ceilings, floors and walls as shown on the drawings. Extend ducts to the flange connection or connector collars on the canopy/ventilator and make the connection thereto.
    - c. Install stainless steel or chrome plated brass excutchions or flanges for utility lines which extend thru equipment.
    - d. install faucets, pre-rinse units, hose stations, pot fillers, vacuum breakers, check valves and flow control valves as furnished by the K.E.C.
  2. Booster Heater
    - a. Install pressure reducing valves, safety relief valves, combination dial thermometer/pressure gauges, shock stops, strainers and other components as furnished by the K.E.C. Connect the hot water outlet on booster to final rinse connection on washer. Refer to booster piping diagram.
  3. Dishwashers
    - a. Install water pressure reducing valves and vacuum breakers.
  4. Disposer



- a. Furnish and install all piping and connect the disposer thru the disposer control panel with all components as furnished by the K.E.C. Refer to disposer piping diagram.
5. Hose Stations
  - a. Install wall mounted hose stations and connect with all accessories as furnished by the K.E.C.
6. Dishtable/Disposer
  - a. Furnish and install all piping and connect water supply thru the disposer control panel and to the scrap trough end water inlets and to the auxiliary inlet on the disposer. Install vacuum breakers and valves as furnished by the K.E.C. Refer to dishtable/disposer piping diagram.
- E. The work to be done by various other trades relating to equipment in this section, unless noted otherwise on the drawings, shall include, but not be limited to, the following:
  1. Walk-In Cooler/Freezer
    - a. Provide floor insulation and curb as furnished and installed by the K.E.C. Over the insulation furnish and install the concrete and finished flooring.
  2. General
    - a. Furnish and install all masonry or concrete bases and platforms.
    - b. Provide floor depressions, wall openings, recesses and holes thru walls, floors and ceiling required for piping and ducts.
  4. Approval of Equipment
    - A. Within fifteen (15) days after award of contract and before any equipment is purchased, the Kitchen Equipment Contractor shall submit to the Architect for approval six (6) bound brochures which will include a complete equipment list giving names of manufacturers', trade names, catalog numbers, model numbers, illustrations and manufacturers' specification sheets on each item, properly numbered, and a separate sheet for each item listing electrical, plumbing, ventilating, etc., connection requirements for said piece of equipment proposed. Two sets of bound service and parts manuals shall also be furnished before final acceptance.
    - B. Within thirty (30) days after Award of Contract, this Contractor shall submit to the Architect for his approval six (6) copies of shop drawings of all custom made items to be manufactured for this project naming the proposed Fabricator thereof. These drawings shall show the detail construction of each part of the equipment. No equipment shall be

fabricated until drawings are approved by the Owner and Food Service Consultant.

- C. The checking of these drawings and approval, of same does not relieve this Contractor of responsibility for errors or omissions, even though in accordance with approved drawings. If errors or omissions exist and are discovered later, they must be made good by this Contractor irrespective of any approval by the Owner or the Food Service Consultant.
- D. The manufacturing of any equipment fitting between walls or between column and walls, shall be withheld until actual field measurements can be taken or predetermined measurements set and approved by the General Contractor. All other items, which do not require field dimensions, may be manufactured upon approval of shop drawings.

#### 5. Guarantee

- A. The Kitchen Equipment Contractor shall deliver to the Owner, before Certificate of Payment will be issued, a written Guarantee covering all equipment and its installation for a period of one (1) year, and refrigeration compressor units for five (5) years after acceptance by Owner.
- B. Should any defects in material or workmanship develop during the guarantee period, same shall be repaired or replaced without charge to Owner by this Contractor.
- C. Service facilities shall be available for all Kitchen Equipment both during and after guarantee period. Service within the guarantee period shall include parts, labor, mileage and travel time at no-charge to the Owner.

#### 6. Materials and Workmanship

##### A. General

- 1. All materials shall be new without flaws or defects. All equipment items shall be designed, fabricated and installed in accordance with current National Sanitation Foundation Standards.
- 2. Any items damaged in transit or during installation shall be repaired, refinished or replaced by the contractor to the satisfaction of the Architect at no additional cost to the Owner.

B. Metal Gauges - U.S. Standard as specified.

C. Sheet Steel: ASTM A446, 1.25 oz/sq ft galvanized coating.

D. Stainless Steel: ASTM A167, Type 304 commercial grade, No. 4 finish.

E. Finish Hardware: Manufacturer's standard.

F. Service Outlet Covers and Escutcheons: Stainless Steel.

G. Sealants: Silicone, bacteria resistant, type, as specified in Section 07900.

#### 6.1. Fabrication - General

- A. Fabricate sheet material for work surfaces, facings, shelves, and drain boards Of straight lengths in one continuous sheet when less than 12 ft in length. Fit And attach integral sinks. Weld metal joints for lengths over 12 ft.
- B. Weld and form edges, ends, and joints smooth. Grind welds of stainless steel Smooth and flush; polish to match adjacent surfaces.
- C. Cut and drill components for service outlets and fixtures.
- D. Fix leg mounted units by dowelling to floor with 1/4 inch stainless steel pins, Where vibration or oscillation is anticipated.
- E. Provide stainless steel legs with adjustable feet. Fasten legs to equipment Securely and rigidly.
- F. Install rubber or nylon button feet on bearing surface of any item positioned on A finished surface.
- G. Isolate rotating or reciprocating machinery to prevent noise and vibration.
- H. Provide indirect drain piping from equipment to terminate over nearest waste Receptor.
- I. Accommodate site installation of other services or equipment.
- J. Shop assemble work where possible.
- K. Stainless Steel Fastenings and Fittings: Bolt and screw with countersunk flat Heads at visible or accessible surfaces. Use concealed fastenings where possible

#### 6.2. Finishes

- A. All components: Shop prefinish.
- B. Metal (Except Stainless Steel): Degrease and phosphate etch, prime and apply Minimum two coats factory baked epoxy enamel, color as selected.
- C. Stainless Steel: No. 4 finish.

- D. Bituminous Paint: Sound deaden internal surfaces of metal work and underside  
Of metal counters.

Conformance to Regulations and Codes

Where applicable standards have been set, all equipment and accessories installed under this contract shall be manufactured and/or fabricated and installed in strict compliance with, and if applicable, bear the Seal of U.L., NEMA, ASME, NSF, AGA, OSHA and NFPA #96. Equipment, accessories and installation shall comply with all rules, regulations, codes, and interpretations of the same.

Specifications  
01/12/2023

To

Project

From

Center for Forensic Psychiatry  
8303 Platt Rd  
Saline, MI 48167  
734-429-2531

Center for Forensic Psychiatry  
8303 Platt Rd  
Saline, MI 48167

ITEM 1 - SERVING LINE (1 REQ'D)  
Randell Custom  
See shop drawings

ITEM 1.1 - CONDIMENT ORGANIZER BIN (1 REQ'D)  
Cambro Model 5412CBP480 Dimensions: 4.25(h) x 5(w) x 12(d)  
Organizer Bin, 5"W x 12"D x 4-1/4"H, polyethylene, speckled gray

ITEM 2 - HAND SINK (8 REQ'D)  
Eagle Group Model BPHS-1014-LRS-NF Dimensions: 13(h) x 17(w) x 15.5(d)  
BlendPort® Hand Sink, wall-mount, 14"W x 10" front-to-back x 5" deep sink bowl, left & right side splashes with 3" radius at front, basket drain, without faucet, 18 gauge type 304 stainless steel construction, NSF (NET)  
8 ea T&S Brass Model B-1115-132X-02 Faucet Workboard, wall mount, 4" centers, 132X gooseneck, B-WH4 handles, quarter-turn Eterna cartridges, low lead, ADA Compliant  
8 kt T&S Brass Model B-1100-K Installation Kit, for workboard wall mount faucets, (2) short EL's

ITEM 3 - BUSSING UTILITY TRANSPORT CART, METAL (3 REQ'D)  
Eagle Group Model UC-311 Dimensions: 32(h) x 16.75(w) x 27.63(d)  
Utility Cart, 3-tier, 16-3/4"W x 27-5/8"D x 32"H, 1" up-turn on sides & rear of top & center shelves, 12-1/2" shelf clearance, (1) push handle, angle legs include bumpers, 300 lbs. capacity, 430 stainless steel all welded construction, 4" swivel plate casters, NSF

ITEM 4 - PASS-THRU REFRIGERATOR (2 REQ'D)  
Delfield Model GARPT2P-SH Dimensions: 79.38(h) x 55.22(w) x 32.44(d)  
Specification Line® Refrigerator, Pass-Thru, two-section, 50.0 cubic feet capacity, top-mounted self-contained refrigeration system, (8) half-height hinged solid doors (locking), (6) adjustable chrome wire shelves, 4.3" easyTouch® screen temperature display/control with remote monitoring, LED interior lighting, stainless steel exterior front, sides & interior, (4) 5" locking casters, GreenGenius™ R290 Hydrocarbon refrigerant, 0.38 HP, 115v/60/1-ph, 6.5 amps, NEMA 5-15P, NSF, cULus, ENERGY STAR®  
2 ea Introducing: Freight Made Simple

6% on Single purchase orders shipping to one location\*\*.  
Liftgate & inside delivery not included.  
Nationwide Freight\*

\*Continental United States only

\*\*6% Must be manually calculated on your purchase order total, \$200 minimum.

If you have any questions, please contact Customer Service at 1-800-733-8948

2 ea Model 0460003CN 3 year parts & labor warranty, standard  
2 ea Model W00003ACN Additional 4 years compressor warranty (parts only), standard  
2 ea Left door hinged on left, right door hinged on right, standard (Thermometer side)  
2 ea Left door hinged on left, right door hinged on right, standard (Rear)  
2 ea Set of (4) 5" locking casters, standard

ITEM 5 - PASS-THRU HEATED CABINET (1 REQ'D)  
Delfield Model GAHPT2-S Dimensions: 79.38(h) x 55.22(w) x 32.44(d)  
Specification Line® Heated Cabinet, Pass-Thru, two-section, 50.0 cubic feet capacity, (4) full-height hinged solid doors (locking), (6) adjustable chrome wire shelves, 4.3" easyTouch® screen temperature display/control with remote monitoring, incandescent interior lighting, stainless steel exterior front, sides & interior, (4) 5" locking casters, 208-240v/60/1-ph, 10.5 amps, NEMA 6-20P, NSF, cULus  
1 ea Introducing: Freight Made Simple

6% on Single purchase orders shipping to one location\*\*.  
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Nationwide Freight\*

\*Continental United States only

\*\*6% Must be manually calculated on your purchase order total, \$200 minimum.

If you have any questions, please contact Customer Service at 1-800-733-8948

- 1 ea Model 0460003CN 3 year parts & labor warranty, standard
- 1 ea Left door hinged on left, right door hinged on right, standard (Thermometer side)
- 1 ea Left door hinged on left, right door hinged on right, standard (Rear)
- 1 ea (Front) Full height solid door, standard
- 1 ea (Front) Full height solid door, standard
- 1 ea (Rear) Full height solid door, standard
- 1 ea (Rear) Full height solid door, standard
- 1 ea Set of (4) 5" locking casters, standard

ITEM 6 - BEVERAGE DISPENSER, COLD BREW AND COFFEE (1 REQ'D)  
BUNN Model 38800.0000 Dimensions: 23.2(h) x 15.78(w) x 20.9(d)  
38800.0000 LCA-2 LP Liquid Coffee Dispenser, ambient, low profile, 2 dispense heads, Scholle 1910LX connector, bag-in-box capacity (2) .05 gallon, dispense ratio 25:1 up to 100:1, refill or rinse LED lights, black, 4" adjustable plastic legs, 120v/60/1-ph, 12 amps, 1440 watts, cord attached, UL, NSF

ITEM 7 - BEVERAGE TABLE (1 REQ'D)  
Randell  
See shop drawings

ITEM 8 - TRAY CONVEYOR (1 REQ'D)  
Aerowerks  
See shop drawings

ITEM 9 - EYE WASH STATION (1 REQ'D)  
Chicago Faucets Model 8401-NF Dimensions: 10.25(h) x 10.25(w) x 14.13(d)  
Eye/Face Wash, wall mount, push handle for activation, drench shower fitting, 1/2" NPT female thread inlet, eyewash assembly in ABS plastic, eyewash bow in stainless steel, brass fittings with galvanized pipe construction  
1 ea Ships 5 business days from order acknowledgement

ITEM 10 - DISHTABLE SORTING SHELF (1 REQ'D)  
Eagle Group Model 605381-X Dimensions: 21.38(h) x 42(w) x 19.75(d)  
Slanted Rack Shelf, solid, wall mount, 42"W x 21"D x 21-3/8"H, drip tube on left side, 16/304 stainless steel (FLYER)

ITEM 11 - PRE-RINSE FAUCET ASSEMBLY (1 REQ'D)  
T&S Brass Model B-0133-CR-B08  
EasyInstall Pre-Rinse Unit, 8" wall mount, 44" flex hose, 6" wall bracket, 18" riser, overhead spring, ceramic cartridge, lever handle, 1.07 GPM spray valve, 1/2" NPT, EPAAct2005 compliant, (B-0108)  
1 kt Model B-0230-K Installation Kit, (2) 1/2" NPT nipples, lock nuts & washers, (2) short "EII" 1/2" NPT female x male

ITEM 12 - DISPOSER (1 REQ'D)

InSinkErator Model SS-300-18B-AS101

SS-300™ Complete Disposer Package, with 18" diameter bowl, 6-5/8" diameter inlet, with sleeve guard & splash baffle, 3 HP motor, stainless steel construction, includes syphon breaker, (2) solenoid valves, (2) flow control valves, programmable AquaSaver® Control Center AS-101 with water-saving technology, automatic water saving function, auto reversing, timed run, post flush

- 1 ea (3) years parts & labor warranty from date of installation (standard)
- 1 ea Standard height disposer body
- 1 ea Specify voltage
- 1 ea Model SYPHON STD Syphon breaker standard, 1/2" (11477)
- 1 ea Model FT FLANGE Flange foot for floor mounting (per leg) (14394)

ITEM 13 - DISHWASHER, CONVEYOR TYPE (1 REQ'D)

Hobart Model CL64EN-ADV+BUILDUP Dimensions: 68.5(h) x 64.75(w) x 30.25(d)

Conveyor Dishwasher, Advansys model, (2) tank, (342) racks/hour, insulated hinged doors, .39 gallon/rack, stainless steel enclosure panels, microprocessor controls with low temperature & dirty water indicators, NSF Pot & Pan mode, programable de-lime notification, 30 kW stainless booster, energy recovery (DWER), automatic soil removal (ASR), drain water tempering kit, ENERGY STAR®, Free factory startup for installations within a 100 mile radius of a Hobart service office; installation beyond 100 miles will be charged at the quoted rate by the local Hobart service office

- 1 ea Oversized units with crated shipping dimensions greater or equal to 72" in length and/or 90" in height. If delivery is to a facility without a standard height dock, additional shipping charges will apply depending on the service requested. consult Factory.
- 1 ea Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA
- 1 ea Model CL64EN-ADVHTE15K Electric tank heat 15kW wash/10kW rinse
- 1 ea Model CL64EN-ADVERH30K 30kW electric booster
- 1 ea Model CL64EN-ADVELE0CD 480v/60/3-ph
- 1 ea Single Point (1) service connection standard (Field convertible options available)
- 1 ea Model CL64EN-ADVHGTSTD Standard height
- 1 ea Model CL64EN-ADVDIR0RL Right to left operation
- 1 ea Model BDERLCD-STDDOM Blower Dryer, Electric, R - L, 480v/60/3-ph, Standard Height, Domestic
- 1 ea NOTE: When blower dryer is selected, only (1) E Series vent hood (below) needed for load/soiled side vent connection; Blower Dryer assembly includes vent stack for unload/clean side vent connection. CLeN Blower Dryer MUST BE DIRECT VENTED, CANNOT BE INSTALLED UNDER CANOPY HOOD
- 1 ea Installation by local Hobart Service Office if within 100 mile radius & done during normal business hours. 72 Hour Assembly Notice Recommended. Must be ordered with Hobart Dishmachine. Price includes assembly of blower dryer to Hobart dishmachine ONLY. Installation of dishmachine can be by others. Does not include drain connection.
- 1 ea Model CL64EN-ADVFETSTD Standard feet
- 2 ea Model WS80-NOINSTALL Water softening system 4,818 grains/lb capacity, 14 gallons regeneration volume, salt alarm, holds 2 bags of salt, pricing DOES NOT include installation. INSTALLATION BY AUTHORIZED HOBART SERVICE OFFICE IS RECOMMENDED (NET)

- 2 ea Model VNTHD/E-ADJ E-series vent hood domestic (adjustable)
- 1 ea Model SHTPAN-RACK Rack, 6 sheet pan
- 1 ea Model 1/2INSHK-ABSRBR Water Shock Absorber Kit (2 required - 1 each incoming hot and cold water lines)
- 1 ea Model CLE/TBL-SWITCH Table limit switch CLE-Series

ITEM 14 - CLEAN DISH TABLE (1 REQ'D)  
Aerowerks  
See shop drawings

ITEM 15 - SHELVING, WALL MOUNTED (1 REQ'D)  
Eagle Group Model WS1284-16/3 Dimensions: 84(w) x 12(d)  
Shelf, wall-mounted, 84"W x 12"D, rolled frontedge, 1-1/2"H up-turn on sides & rear, includes stainless steel mounting brackets stud welded to shelf, 16/304 stainless steel construction, NSF

ITEM 16 - RACK DOLLY (3 REQ'D)  
Eagle Group Model GRDH-2020-A Dimensions: 39(h) x 20.63(w) x 22.38(d)  
Panco® Glass Rack Dolly, with handle, open frame design, single stack, for 20" x 20" racks, heavy duty welded, all aluminum construction, 5" non-marking swivel plate casters, 1200 lb. capacity, NSF

ITEM 17 - TRAY RACK DISPENSER (2 REQ'D)  
Delfield Model TT2-1622 Dimensions: 37.75(h) x 44.5(w) x 26.75(d)  
Dispenser, Tray, open frame mobile design, dual self-elevating tray platforms, for 16" x 22" trays, 4" casters, NSF  
2 ea NOTE: Freight quotes are only valid from Delfield  
2 ea Model 0460000N 1 year parts & labor warranty, standard

ITEM 18 - DISH CART / DOLLY (3 REQ'D)  
Cambro Model TDC2029615 Dimensions: 34.25(h) x 38.13(w) x 22.25(d)  
Dish Cart Only, 38-1/8"L x 22-1/4"W x 34-1/4"H, (4) 6" swivel casters, polyethylene, charcoal gray, NSF

ITEM 19 - STORAGE/DRYING CART (1 REQ'D)  
Dinex Model DX1173X100 Dimensions: 73(h) x 40(w) x 20.25(d)  
TMP® Drying & Storage Cart, holds 100 domes or 200 bases/underliners or Quicktemp® bases, 1" stainless steel tubing frame, 5" casters (2 with brakes) (1173/X100)  
1 ea 1 year parts & labor warranty

ITEM 20 - ICE MAKER, CUBE-STYLE (1 REQ'D)  
Manitowoc Model IDT0450A Dimensions: 21.5(h) x 30(w) x 24(d)  
Indigo NXT™ Series Ice Maker, cube-style, air-cooled, self-contained condenser, 30"W x 24"D x 21-1/2"H, production capacity up to 470 lb./24 hours at 70°/50° (358 lb. AHRI certified at 90°/70°), easyTouch display with 13 different language options, date/time stamp display, automatic reminder/alert icon, one touch asset information, automatic detection of accessories, continuous operating status, programmable production options (time, weight, day or night), one touch cleaning with displayed instructions, Alpha-San anti-microbial protection, acoustical ice sensing probe, self-diagnostic technology, DuraTech™ exterior, dice size cubes, R410A refrigerant, NSF, cULus, CE, ENERGY STAR® \*\*(An additional 5% Manufacture's surcharge will be added to list price between 11/8/21 to 1/2/22)\*\*



- 1 ea Model WARRANTY-ICE-SC 3 year parts & labor (Machine), 5 year parts & labor (Evaporator), 5 year parts & 3 years labor (Compressor), standard \*\*(An additional 5% Manufacture's surcharge will be added to list price between 11/8/21 to 1/2/22)\*\*
- 1 ea (-161) 115v/60/1-ph, 11.9 amps
- 1 ea Model D570 Ice Bin, 30"W x 34"D x 50"H, with side-hinged front-opening door, side grips, 532 lbs. application capacity, AHRI certified 17.9 cu. ft., for top-mounted ice maker, Duratech exterior, NSF \*\*(An additional 5% Manufacture's surcharge will be added to list price between 11/8/21 to 1/2/22)\*\*
- 1 ea Model WARRANTY-BIN/DISP 3 year parts & labor warranty, standard \*\*(An additional 5% Manufacture's surcharge will be added to list price between 11/8/21 to 1/2/22)\*\*
- 1 ea Legs, 6" adjustable stainless steel, standard

ITEM 21 - WATER FILTRATION SYSTEM, FOR ICE MACHINES (1 REQ'D)  
Everpure Model EV932401 Dimensions: 27.5(h) x 6(w) x 4(d)  
Insurice® Single-i2000<sup>2</sup> System, 9,000 gallon capacity, 1.67 gpm flow rate, 0.5-micron filtration, for cubers up to 500 lbs/day or flakers up to 1,500 lbs/day, pressure gauge, flushing valve, NSF, ANSI

ITEM 22 - FLOOR TROUGH (1 REQ'D)  
Eagle Group Model ASFT-1284-FG Dimensions: 84(w) x 12(d)  
Anti-Splash Floor Trough, 84"W x 12"D, yellow fiberglass subway-style grating with non-slip surface, 6" deep trough pan with built-in pitch toward drain, accommodates up to a 4" diameter drain pipe, stainless steel removable perforated basket, all-welded 14/304 stainless steel construction, NSF  
1 ea ADA-compliant grating

ITEM 23 - FLOOR TROUGH (1 REQ'D)  
Eagle Group Model ASFT-2424-FG Dimensions: 24(w) x 24(d)  
Anti-Splash Floor Trough, 24"W x 24"D, yellow fiberglass subway-style grating with non-slip surface, 6" deep trough pan with built-in pitch toward drain, accommodates up to a 4" diameter drain pipe, stainless steel removable perforated basket, all-welded 14/304 stainless steel construction, NSF  
1 ea ADA-compliant grating

ITEM 24 - WIRE SHELVING (4 REQ'D)  
Eagle Group Model 2448VG Dimensions: 48(w) x 24(d)  
Shelf, wire, 48"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 800 lbs. capacity, Valu-Gard® green epoxy finish, NSF  
4 ea Model P74-VG Post, stationary, 74"H, grooved in 1" increments, includes post cap & leveling bolt, Valu-Gard® green epoxy finish, NSF

ITEM 25 - THREE (3) COMPARTMENT SINK (1 REQ'D)  
Eagle Group Model FN2472-3-30-14/3 Dimensions: 44.5(h) x 138(w) x 31(d)  
Spec-Master® FN Series Sink, three compartment, 138"W x 31"D, 14/304 stainless steel top, coved corners, 24" x 24" x 14" deep compartments, 30" drainboards on left & right, 9-1/2"H backsplash with 1" upturn & tile edge, (2) sets of 8" OC splash mount faucet holes, rolled edges on front & sides, includes 3-1/2" basket drains, stainless steel crossbracing on all sides, stainless steel legs & adjustable bullet feet, NSF  
1 ea Model E101A Turn down back of splash per table with Z clip

- 1 ea Model E41A Disposal provision package, includes: weldment only for cone which are furnished by others, control panel bracket weldment, & holes for pre-rinse & anti-siphon vacuum breaker  
Note: Faucet(s) and Drain(s) by Others.
- 2 ea T&S Brass Model B-0290 Sink Mixing Faucet, wall mount, 8" adjustable centers, 12" Big-Flo swing nozzle with plain end outlet, 4-arm kitchen handles with color coded indexes, OOLL street elbows with 3/4" female NPT inlets, ADA Compliant
- 1 ea NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.
- 3 ea Model -TB Twist brackets for 3 comp 412, 414 & 314 sinks
- 3 ea add overflow hole punch
- 3 ea T&S Brass Model B-3952-01 Waste Valve, twist handle, 3-1/2" sink opening, 2" drain outlet with overflow assembly (replaces B-3917-01)
- 1 ea T&S Brass Model B-0133-B EasyInstall Pre-Rinse Unit, wall mount. base faucet with spring check cart. & lever handles, 2" dia. flanges with 1/2" NPT female eccentric flanged inlets, 35-1/2"H, 15" overhang, 8-1/4" clearance, 18" riser, (B-0107) spray valve, B-0044-H flex stainless steel hose, 6" wall bracket, quarter-turn Eterna cartridges, low lead
- 1 kt T&S Brass Model B-0230-K Installation Kit, (2) 1/2" NPT nipples, lock nuts & washers, (2) short "Ell" 1/2" NPT female x male

ITEM 26 - DISPOSER (1 REQ'D)

InSinkErator Model SS-200-15B-AS101

SS-200™ Complete Disposer Package, with 15" diameter bowl, 6-5/8" diameter inlet, with sleeve guard & splash baffle, 2 HP motor, stainless steel construction, includes syphon breaker, (2) solenoid valves, (2) flow control valves, programmable AquaSaver® Control Center AS-101 with water-saving technology, automatic water saving function, auto reversing, timed run, post flush, adjustable leg kit

- 1 ea (3) years parts & labor warranty from date of installation (standard)
- 1 ea Standard height disposer body
- 1 ea Specify voltage
- 1 ea Model SYPHON 45DEG Syphon breaker upgrade, chrome, 45° fittings (replace with 13412)

ITEM 27 - POT RACK (1 REQ'D)

Eagle Group Model WM48PR-X Dimensions: 16(h) x 48(w) x 12(d)

Pot Rack, wall mount, 48"W x 12"D x 16"H, double-bar design, constructed of 3/16" x 2" stainless steel flat bar, includes (8) double-pronged pot hooks, NSF (FLYER)

- 1 ea Model 300696-X Pot Hook, stainless steel (FLYER)

ITEM 28 - SHELVING, WALL MOUNTED (1 REQ'D)

Eagle Group Model WS1248-16/3 Dimensions: 48(w) x 12(d)

Shelf, wall-mounted, 48"W x 12"D, rolled frontedge, 1-1/2"H up-turn on sides & rear, includes stainless steel mounting brackets stud welded to shelf, 16/304 stainless steel construction, NSF

ITEM 29 - SPARE NO. <Spare No.>

ITEM 30 - FLOOR TROUGH (1 REQ'D)

Eagle Group Model ASFT-1248-FG Dimensions: 48(w) x 12(d)  
Anti-Splash Floor Trough, 48"W x 12"D, yellow fiberglass subway-style grating with non-slip surface, 6" deep trough pan with built-in pitch toward drain, accommodates up to a 4" diameter drain pipe, stainless steel removable perforated basket, all-welded 14/304 stainless steel construction, NSF

1 ea ADA-compliant grating

ITEM 31 - HOSE REEL (1 REQ'D)

T&S Brass Model B-7133-07 Dimensions: 20.56(h) x 9.56(w) x 21.06(d)  
Hose Reel System, open, 1/2" x 35' hose with stainless steel front trigger spray valve (with a 9/16" orifice), with ratcheting system & adjustable hose bumper, stainless steel

1 ea 1 year limited warranty for hose, standard

1 ea 2 year limited warranty for hose reel, standard

ITEM 32 - MOP SINK (1 REQ'D)

Eagle Group Model F2820-12-X Dimensions: 19.5(h) x 32.63(w) x 25.5(d)  
Mop Sink, floor mount, 32-5/8"L x 25-1/2" W x 19-1/2"H overall, 28" wide x 20" front-to-back x 12" deep bowl, 16 gauge top with "V" edge, full skirt, 2" NPS drain with stainless steel removable strainer plate, 304 stainless steel construction, NSF (FLYER)

1 ea NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.

1 ea Model 312688-X Mop Holder, 18"W, holds (3) mops (FLYER)  
or by MC?

ITEM 33 - SPARE NO. <Spare No.>

ITEM 34 - SPARE NO. <Spare No.>

ITEM 36 - UNIVERSAL PAN RACK (8 REQ'D)

Eagle Group Model 4339 Dimensions: 73(h) x 21.5(w) x 26(d)  
Lifetime Series Bun Pan Rack, universal, 21-1/2" x 26" x 73"H, (20) 18" x 26" or (19) 12" x 20" pan capacity, (40) 13" x 18" pan capacity or (40) 14" x 18" tray capacity, slides on 3" centers, fully welded aluminum construction, (4) 6" x 2" non-marking swivel plate casters, NSF

8 ea NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.

ITEM 37 - SPARE NO. <Spare No.>

ITEM 38 - SPARE NO. <Spare No.>

ITEM 39 - VENTILATION SYSTEM (1 REQ'D)

Captive-Aire  
See shop drawings

ITEM 40 - FIRE SUPPRESSION (2 REQ'D)

Custom  
See shop drawings

ITEM 41 - UDS (1 REQ'D)

Captive Aire

See shop drawings

ITEM 42 - FAUCET, KETTLE / POT FILLER (2 REQ'D)  
T&S Brass Model B-0610-CR

Pot Filler, splash/wall mount, 8" OC, 68" flexible stainless steel hose with hook nozzle, lever handles, Cerama cartridges with check valves, vacuum breaker, 1/2" NPT female inlets, low lead

ITEM 43 - SPARE NO. <Spare No.>

ITEM 44 - SPARE NO. <Spare No.>

ITEM 45 - SPARE NO. <Spare No.>

ITEM 46 - SPARE NO. <Spare No.>

ITEM 47 - SPARE NO. <Spare No.>

ITEM 48 - SPARE NO. <Spare No.>

ITEM 49 - SPARE NO. <Spare No.>

ITEM 50 - RANGE, 36", 6 OPEN BURNERS (1 REQ'D)

Vulcan Model 36S-6BN Dimensions: 58(h) x 36(w) x 34(d)

Endurance™ Restaurant Range, natural gas, 36", (6) 30,000 BTU burners, lift-off burner heads, standard oven, stainless steel front, sides, backriser, & lift-off high shelf, fully MIG welded chassis, 6" adjustable legs, 215,000 BTU, CSA, NSF

1 ea 1 year limited parts & labor warranty, standard

1 ea Stainless steel backriser & lift-off high shelf, standard

1 ea Model STUB4-XL36 4" Stub back, for 36" ranges, stainless steel

1 st Model CASTERS-RR4 Casters, 5" (set of 4) (2 with locks)

ITEM 51 - GRIDDLE, GAS, COUNTERTOP (1 REQ'D)

Vulcan Model MSA60 Dimensions: 15.25(h) x 60(w) x 31.5(d)

Heavy Duty Griddle, countertop, gas, 60" W x 24" D cooking surface, 1" thick polished steel griddle plate, embedded mechanical snap action thermostat every 12", millivolt pilot safety, manual ignition, low profile, stainless steel front, sides, front grease trough, 6 qt. grease can, 4" back & tapered side splashes, 4" adjustable legs, 135,000 BTU, CSA Star, CSA Flame, NSF

1 ea 1 year limited parts & labor warranty, standard

1 ea Natural gas (specify elevation if over 2,000 ft.)

1 ea Model PLTRAIL-60 Plate Rail, 60" wide x 10-5/8" deep, stainless steel (NOTE: Not compatible with rear grease trough griddles)

1 ea Eagle Group Model T3060SGS Griddle/Equipment Stand, 60-3/8"W x 30-3/8"D x 25-1/4"H, 16/300 stainless steel top, 1-1/4"H up-turn on sides & rear, open base with stainless steel adjustable undershelf, 1000 lbs weight capacity, Uni-Lok® gusset system, (4) stainless steel legs with adjustable white metal feet, NSF

1 ea Eagle Group NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.

- 1 ea Eagle Group Model 307107 Cutting Board, equipment-mounted, 60"W x 8"D, 1-1/4" thick laminated hardwood, 1" diameter stainless steel tubular supports integrally welded to adjustable stainless steel sleeve assembly, NSF
- 1 st Eagle Group Model CAH4-SB Table Casters, set of (4), 5" diameter, (2) swivel & (2) swivel/brake, 200 lbs. capacity per caster, zinc with resilient tread, NSF

ITEM 52 - COMBI OVEN, GAS (1 REQ'D)

RATIONAL Model ICP 20-FULL NG 208/240V 1 PH (LM100GG) Dimensions: 71.13(h) x 42.6(w) x 41.4(d)

(CG1GRRA.0000245 - NG - 208/240V) iCombi Pro® 20-Full Size Combi Oven, natural gas, (20) 18" x 26" sheet pan or (40) 12" x 20" steam pan or (20) 2/1 GN pan capacity, mobile oven rack & (10) stainless steel grids included, intelligent cooking system with (4) assistants; iDensityControl, iCookingSuite, iProductionManager, & iCareSystem, (6) operating modes, (5) cooking methods, (3) manual operating modes, 85° to 572°F temperature range, quick clean, care control, eco mode, 6-point core temperature probe, retractable hand shower, Ethernet interface, Wi-Fi enabled, includes (1) bucket of Active Green Cleaner & (1) bucket of Care Tabs, 303,500 BTU, 208/240v/60/1-ph, 6 ft. cord, 2.2 kW, IPX5, cCSAus, NSF, ENERGY STAR®

- 1 ea NOTE: All discounts subject to approval by manufacturer
- 1 ea 2 years parts and labor, 5 years steam generator warranty
- 1 ea Model CAP Chef Assistance Program, a RATIONAL certified Chef conducts 4 hours/location specialized application training with personnel, no charge

ITEM 53 - CONVECTION OVEN, GAS (2 REQ'D)

Vulcan Model VC44GD Dimensions: 70(h) x 40(w) x 42.25(d)

Convection Oven, gas, double-deck, standard depth, solid state controls, electronic spark igniters, 60 minute timer, (5) nickel plated racks per oven, 8" high legs, stainless steel front, top & sides, stainless steel doors with windows, (2) 50,000 BTU, NSF, CSA Star, CSA Flame, ENERGY STAR®

- 2 ea 1 year limited parts & labor warranty, standard
- 2 ea Natural gas (specify elevation if over 2,000 ft.)
- 2 ea (2) 120v/60/1-ph, 15.4 amps total, (2) cords with plugs, standard
- 2 ea Gas manifold piping included with stacking kit to provide single point gas connection
- 2 ea Simultaneous doors, bottom oven
- 2 st Casters, set of (4) in lieu of standard legs

ITEM 54 - CONVECTION STEAMER, GAS (1 REQ'D)

Cleveland Range Model 24CGA10.2 Dimensions: 65.5(h) x 24(w) x 33(d)

Steamcraft® Gemini™ 10 Convection Steamer, pressureless, gas, 2 compartments with individual generators, (5) 12 x 20 x 2-1/2 pans/compartiment capacity, SureCook controls, 60-minute mechanical timer & manual (continuous steaming) bypass switch, left-hand hinged door, controls on right, 1 standard treated & tap water connection, stainless steel construction, 6" adjustable legs with flanged feet, 144,000 BTU total

- 1 ea 1-year parts & labor warranty, standard
- 1 ea 5 year pro-rated parts warranty on boilers & steam generators
- 2 ea 3 year Convection Steamer Door Warranty, standard
- 1 ea Performance start-up included at customer request after equipment is installed (Free Water Quality Check included) (contact Cleveland Sales Representative for details)
- 1 ea Gas type to be specified

1 ea (VOS115) 120v/60/1-ph, 2 blowers & controls, 150 watts each (DO NOT connect to GFI outlet)

ITEM 55 - HD RANGE, 36", 6 OPEN BURNERS (1 REQ'D)  
Vulcan Model V6B36S Dimensions: 36(h) x 36(w) x 36.75(d)  
V Series Heavy Duty Range, gas, 36", (6) 35,000 BTU open burners, cast iron grates, standard oven, stainless steel front, front top ledge, sides, base, burner box & stub back, 6" adjustable legs, 260,000 BTU, CSA, NSF

1 ea 1 year limited parts & labor warranty, standard  
1 ea Natural gas (specify elevation if over 2,000 ft.)  
1 ea NOTE: A regulator must be used on this equipment  
1 ea 1-1/4" rear gas connection, standard  
1 ea Rear gas connection: cap & cover, both ends

ITEM 56 - CONVECTION OVEN, GAS (1 REQ'D)  
Vulcan Model VC44GD Dimensions: 70(h) x 40(w) x 42.25(d)  
Convection Oven, gas, double-deck, standard depth, solid state controls, electronic spark igniters, 60 minute timer, (5) nickel plated racks per oven, 8" high legs, stainless steel front, top & sides, stainless steel doors with windows, (2) 50,000 BTU, NSF, CSA Star, CSA Flame, ENERGY STAR®

1 ea 1 year limited parts & labor warranty, standard  
1 ea Gas type to be specified  
1 ea (2) 120v/60/1-ph, 15.4 amps total, (2) cords with plugs, standard  
1 ea Gas manifold piping included with stacking kit to provide single point gas connection  
2 ea Simultaneous doors, both ovens  
1 st Casters, set of (4) in lieu of standard legs

ITEM 57 - KETTLE, GAS, TILTING (1 REQ'D)  
Groen Model DH-40A Dimensions: 43.13(h) x 47(w) x 34.63(d)  
Tilting Kettle, gas, 40-gallon capacity, crank tilt, 2/3 jacket, IPX6 water rated electronic Advanced controls with digital display, 1 minute to 10 hour timer, low (2) and high (7) preset intensities with manual capability, 316 stainless steel liner, floor mounted control console supports, stainless steel construction, bullet feet, electronic ignition, 50 PSI, 0 - 2000' elevation, 100,000 BTU, cCSAus, NSF, Made in USA

1 ea (1) year parts & labor, (10) year hemisphere warranty, standard  
1 ea Gas type to be specified  
1 ea Model ELEVO-2000 For elevation between 0 and 2000 (When order is placed, all equipment with elevation specified will be assigned a different Part# by the factory)  
1 ea 115v/60/1-ph, 5.0 amps, std.

ITEM 58 - TILTING SKILLET BRAISING PAN, GAS (1 REQ'D)  
Groen Model BPM-40GA Dimensions: 43.5(h) x 48(w) x 39.75(d)  
Braising Pan, gas, 40-gallon capacity, 10" deep pan, 38" pan height, IPX6 water rated electronic Advanced controls with digital display, 1 minute to 10 hour timer, 175° - 400°F preset temperatures along with manual setting capability, manual tilt, standard etch marks, faucet bracket, round tubular open leg base, stainless steel construction, bullet feet, electric spark ignition, 144,000 BTU/hr, cCSAus, NSF, IPX6, Made in USA

1 ea (1) year parts & labor, (10) year pan warranty, standard  
1 ea 115v/60/1-ph, 5.0 amps, standard

- 1 ea Gas type to be specified
- 1 ea Model ELEVO-2000 For elevation between 0 and 2000 (When order is placed, all equipment with elevation specified will be assigned a different Part# by the factory)

ITEM 59 - FLOOR TROUGH (1 REQ'D)

Eagle Group Model ASFT-2424-FG Dimensions: 24(w) x 24(d)

Anti-Splash Floor Trough, 24"W x 24"D, yellow fiberglass subway-style grating with non-slip surface, 6" deep trough pan with built-in pitch toward drain, accommodates up to a 4" diameter drain pipe, stainless steel removable perforated basket, all-welded 14/304 stainless steel construction, NSF

- 1 ea NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.
- 1 ea ADA-compliant grating

ITEM 60 - FLOOR TROUGH (1 REQ'D)

Eagle Group Model ASFT-2436-FG Dimensions: 36(w) x 24(d)

Anti-Splash Floor Trough, 36"W x 24"D, yellow fiberglass subway-style grating with non-slip surface, 6" deep trough pan with built-in pitch toward drain, accommodates up to a 4" diameter drain pipe, stainless steel removable perforated basket, all-welded 14/304 stainless steel construction, NSF

- 1 ea NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.
- 1 ea ADA-compliant grating

ITEM 63 - SPARE NO. <Spare No.>

ITEM 64 - SPARE NO. <Spare No.>

ITEM 65 - BLAST CHILLER FREEZER, REACH-IN (1 REQ'D)

American Panel Corporation Model AP12BCF110-3 Dimensions: 74(h) x 32.25(w) x 36.13(d)  
HURRiCHILL™ Blast Chiller/Shock Freezer, Reach-in, self-contained, (24) 12" x 20" x 2.5" or (12) 18" x 26" pan capacity, 110 lbs. from 160° F to 38° F blast chill capacity/90 minutes, 90 lbs. 160° F to 0° F freeze capacity/240 minutes, 7" LCD touch screen controller with Quick Start & A La Carte functionality, (1) heated food probe, stainless steel interior & exterior, 6" stainless steel legs, 3 HP, UL CLASSIFIED EPH, cUL, ANSI/NSF

- 1 ea 1 year parts & labor warranty standard on cabinet only
- 1 ea 5 year compressor warranty is standard, 1 year parts, labor not included
- 1 ea Standard Refrigeration, R404a refrigerant
- 1 ea 208v/60/3-ph, 10.0 amps, 6' cord, NEMA L15-20P
- 1 ea Drain line assembly
- 1 ea Condensate evaporator
- 1 ea Wi-Fi communication

ITEM 66 - PLANETARY MIXER (1 REQ'D)

Hobart Model HL800-2STD

Legacy Planetary Mixer, 80 quart, (4) fixed speeds plus stir speed, gear-driven transmission, 20-Minute SmartTimer™, power bowl lift, stainless steel bowl guard, stainless steel bowl, "B" beater, "ED" dough hook, bowl truck, 3.0 HP, 380-460v/50/60/3-ph (US & Export configuration)

- 1 ea Standard warranty: 1-Year parts, labor & travel time during normal working hours within the USA
- 1 ea Model TRUCK-HL1486 Legacy® Mixer Bowl Truck, aluminum, for use with 60, 80 & 140 quart mixers

ITEM 67 - WORK TABLE, STAINLESS STEEL TOP (4 REQ'D)

Eagle Group Model T3072SE-BS Dimensions: 39.63(h) x 72(w) x 30(d)

Spec-Master® Series Work Table, 72"W x 30"D, 4-1/2"H backsplash, 14/300 series stainless steel top, rolled front edge, adjustable 18/300 series stainless steel undershelf with marine edge, Uni-Lok® gusset system, (4) stainless steel legs & adjustable bullet feet, NSF

- 4 ea Model E101A Turn down back of splash per table with Z clip
- 4 ea Model E23 Sink, 16" x 20" x 14" bowl, for 30"W tables, complete with faucet & basket drain (specify location)
- 4 ea T&S Brass Model 5F-4CW10 Equip Workboard Faucet, 4" OC deck mount, 10" swing nozzle, quarter-turn ceramic cartridge, 4" wrist action handles, low lead, ADA Compliant
- 4 ea T&S Brass Model B-3952-01 Waste Valve, twist handle, 3-1/2" sink opening, 2" drain outlet with overflow assembly (replaces B-3917-01)
- 4 ea Model -TB Twist bracket, per drain
- 4 ea add overflow hole punch
- 4 ea Model E32 Can opener hole with under table support (specify location)

ITEM 68 - SHELVING, WALL MOUNTED (2 REQ'D)

Eagle Group Model WS1272-16/3 Dimensions: 72(w) x 12(d)

Shelf, wall-mounted, 72"W x 12"D, rolled front edge, 1-1/2"H up-turn on sides & rear, includes stainless steel mounting brackets stud welded to shelf, 16/304 stainless steel construction, NSF

- 2 ea NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.

ITEM 69 - PLANETARY MIXER (1 REQ'D)

Hobart Model HMM20-1STD

Centerline Planetary Mixer, 20 quart capacity, (3) fixed speeds, gear-driven transmission, digital controls, last time remind, stainless steel bowl, removable bowl guard, includes bayonet style wire whip, flat beater & dough hook, 1/2 HP motor, 100-120v/50/60/1-ph (Net)

- 1 ea Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA
- 1 ea Model VS9-12 9" Vegetable Slicer for #12 attachment hub; includes back case, hopper front, & adjustable slicer plate, NSF
- 1 ea Model VS9HOLD-SHG12 Plate Holder #12 hub, mounts shredder & grater plates
- 1 ea Model VS9PLT-1/2SH 1/2" Shredder Plate
- 1 ea Model VS9PLT-3/16SH 3/16" Shredder Plate

ITEM 70 - EQUIPMENT STAND, FOR MIXER / SLICER (1 REQ'D)

Eagle Group Model MS2424S Dimensions: 24(h) x 24(w) x 24(d)

Mixer Stand, stationary, 24"W x 24"D x 24"H, 16/300 series stainless steel top with 600 lbs. capacity, rolled front edge, stainless steel adjustable undershelf with 150 lbs. capacity, Uni-Lok® gusset system, stainless steel legs with adjustable stainless steel bullet feet, NSF

- 1 ea NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.



1 st Model CA4-SB Table Casters, set of (4), 4" diameter, (2) swivel & (2) swivel/brake, 115 lbs. capacity per caster, zinc with resilient tread, NSF

ITEM 71 - WORK TABLE, STAINLESS STEEL TOP (1 REQ'D)  
Eagle Group Model T3060STE-BS Dimensions: 39.63(h) x 60(w) x 30(d)  
Spec-Master® Series Work Table, 60"W x 30"D, 4-1/2"H backsplash, 14/300 series stainless steel top, rolled front edge, Uni-Lok® gusset system, stainless steel crossrails on side & rear, (4) stainless steel legs & adjustable bullet feet, NSF

1 ea Model E101A Turn down back of splash per table with Z clip

ITEM 72 - SHELVING, WALL MOUNTED (1 REQ'D)  
Eagle Group Model WS1260-16/3 Dimensions: 60(w) x 12(d)  
Shelf, wall-mounted, 60"W x 12"D, rolled frontedge, 1-1/2"H up-turn on sides & rear, includes stainless steel mounting brackets stud welded to shelf, 16/304 stainless steel construction, NSF

1 ea NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.

ITEM 73 - INGREDIENT BIN (1 REQ'D)  
Cambro

1 ea Model IB44148 Ingredient Bin, mobile, 42-1/2 gallon capacity, molded polyethylene with sliding cover, (4) 3" heavy duty casters (2 front swivel, 2 fixed), with bin securely attached to base plate, white with clear cover, NSF

1 ea Model IBS20148 Ingredient Bin, mobile, 21 gallon capacity, molded polyethylene with sliding cover, S-hook on front (scoop NOT included), (4) 3" heavy duty casters (2 front swivel, 2 fixed), with bin securely attached to base plate, white with clear cover, NSF

1 ea Model IBS27148 Ingredient Bin, mobile, 27 gallon capacity, 1-pc seamless polyethylene bin, 2-pc sliding polycarbonate lid, S-hook on front (scoop NOT included), (4) 3" heavy duty casters (2 front swivel, 2 fixed), white with clear cover, NSF

ITEM 74 - WORK TABLE, STAINLESS STEEL TOP (1 REQ'D)  
Eagle Group Model T3096SE-BS Dimensions: 39.63(h) x 96(w) x 30(d)  
Spec-Master® Series Work Table, 96"W x 30"D, 4-1/2"H backsplash, 14/300 series stainless steel top, rolled front edge, adjustable 18/300 series stainless steel undershelf with marine edge, Uni-Lok® gusset system, (6) stainless steel legs & adjustable bullet feet, NSF

1 ea Model E101A Turn down back of splash per table with Z clip

1 ea Model 502943 Drawer Assembly, 20" x 15" x 5", 430 type stainless steel, removable drawer pan, hemmed safety pull handle (table must be field drilled for mounting)

ITEM 75 - SHELVING, WALL MOUNTED (2 REQ'D)  
Eagle Group Model WS1248-16/3 Dimensions: 48(w) x 12(d)  
Shelf, wall-mounted, 48"W x 12"D, rolled frontedge, 1-1/2"H up-turn on sides & rear, includes stainless steel mounting brackets stud welded to shelf, 16/304 stainless steel construction, NSF

2 ea NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.

ITEM 76 - CAN OPENER (1 REQ'D)

Edlund Model S-11WB

Can Opener, manual, 16" bar length, max can height of 13" dishwasher safe, rust proof, stainless steel without base, NSF certified

1 ea 5 year limited warranty, standard

ITEM 77 - WORK TABLE, STAINLESS STEEL TOP (3 REQ'D)

Eagle Group Model T3096SE Dimensions: 36.13(h) x 96(w) x 30(d)

Spec-Master® Series Work Table, 96"W x 30"D, 14/300 series stainless steel top, rolled edge on front & back, adjustable 18/300 series stainless steel undershelf with marine edge, Uni-Lok® gusset system, (6) stainless steel legs & adjustable bullet feet, NSF

3 ea Model 502943 Drawer Assembly, 20" x 15" x 5", 430 type stainless steel, removable drawer pan, hemmed safety pull handle (table must be field drilled for mounting)

ITEM 78 - WORK TABLE, STAINLESS STEEL TOP (3 REQ'D)

Eagle Group Model T3072SE-BS Dimensions: 39.63(h) x 72(w) x 30(d)

Spec-Master® Series Work Table, 72"W x 30"D, 4-1/2"H backsplash, 14/300 series stainless steel top, rolled front edge, adjustable 18/300 series stainless steel undershelf with marine edge, Uni-Lok® gusset system, (4) stainless steel legs & adjustable bullet feet, NSF

3 ea Model E101A Turn down back of splash per table with Z clip

3 ea Model 502943 Drawer Assembly, 20" x 15" x 5", 430 type stainless steel, removable drawer pan, hemmed safety pull handle (table must be field drilled for mounting)

ITEM 79 - SHELVING, WALL MOUNTED (3 REQ'D)

Eagle Group Model WS1272-16/3 Dimensions: 72(w) x 12(d)

Shelf, wall-mounted, 72"W x 12"D, rolled front edge, 1-1/2"H up-turn on sides & rear, includes stainless steel mounting brackets stud welded to shelf, 16/304 stainless steel construction, NSF

3 ea NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.

ITEM 80 - SPARE NO. <Spare No.>

ITEM 81 - SPARE NO. <Spare No.>

ITEM 82 - WORK TABLE, STAINLESS STEEL TOP (2 REQ'D)

Eagle Group Model T3096SE-BS Dimensions: 39.63(h) x 96(w) x 30(d)

Spec-Master® Series Work Table, 96"W x 30"D, 4-1/2"H backsplash, 14/300 series stainless steel top, rolled front edge, adjustable 18/300 series stainless steel undershelf with marine edge, Uni-Lok® gusset system, (6) stainless steel legs & adjustable bullet feet, NSF

2 ea Model E101A Turn down back of splash per table with Z clip

2 ea Model 502943 Drawer Assembly, 20" x 15" x 5", 430 type stainless steel, removable drawer pan, hemmed safety pull handle (table must be field drilled for mounting)

2 ea Model E15 Vertical tray dividers, four-section assembly, 3" on centers

ITEM 83 - SHELVING, WALL MOUNTED (4 REQ'D)

Eagle Group Model WS1248-16/3 Dimensions: 48(w) x 12(d)

Shelf, wall-mounted, 48"W x 12"D, rolled frontedge, 1-1/2"H up-turn on sides & rear, includes stainless steel mounting brackets stud welded to shelf, 16/304 stainless steel construction, NSF

4 ea NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.

ITEM 84 - FOOD SLICER, ELECTRIC (1 REQ'D)

Hobart Model HS7-1 Dimensions: 27.25(h) x 24.63(w) x 30.31(d)

Heavy Duty Meat Slicer, automatic, 13" CleanCut™ removable knife with removal tool, burnished finish, (3) stroke lengths, & (4) stroke speeds, removable meat grip assembly, removable ring guard cover, product fence, single action top mounted sharpener with Borazon™ stones, manual lift lever, 1/2 hp motor, 5.6amps, 120v/60hz/1-ph, NSF cETLus

1 ea Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA

ITEM 85 - FOOD PROCESSOR, BENCHTOP / COUNTERTOP (1 REQ'D)

Hobart Model FP41-1 Dimensions: 17.2(h) x 10.2(w) x 13.4(d)

Food Processor, 4 qt. bowl design, 1725 rpm, stainless steel bowl with see-thru cover, bowl-scraper, direct drive motor, triple safety interlocks, anodized aluminum base, rubber ft, (unit only) 120/60/1, 3/4 hp, 8' cord with plug

1 ea Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA

ITEM 86 - FOOD PROCESSOR, BENCHTOP / COUNTERTOP (1 REQ'D)

Hobart Model FP350-1 Dimensions: 29.31(h) x 13.44(w) x 21.88(d)

Food Processor - Unit Only, angled continuous feed design, full-size hopper, 26 lb per/min production cap., 430 rpm, stainless steel cutting surfaces, planetary gear transmission, triple safety interlocks, aluminum housing, rubber feet, 120/60/1, 1 HP, 10 amps, UL, NSF

1 ea Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA

1 ea Model 3SLICE-1/8-SS 1/8" Slicing Plate (3mm), stainless steel

1 ea Model 3SLICE-5/32-SS 5/32" Slicing Plate (4mm), stainless steel

1 ea Model 3SLICE-3/8-SS 3/8" Slicing Plate (10mm), stainless steel

1 ea Model 3JUL-5/64-SS 5/64" Julienne Plate (2mm), stainless steel

1 ea Model 3SHRED-1/8-SS 1/8" Shredder Plate (3mm), stainless steel

1 ea Model 3SHRED-5/32-SS 5/32" Shredder Plate (4mm), stainless steel

1 ea Model S35DICE-3/8 3/8" Dicer Plate (10mm), stainless steel (for use with 3-10mm slicer plate)

1 ea Model S35DICE-1/2 1/2" Dicer Plate (12.5mm), stainless steel (for use with 3-10mm slicer plate)

ITEM 87 - SPARE NO. <Spare No.>

ITEM 88 - SPARE NO. <Spare No.>

ITEM 89 - SPARE NO. <Spare No.>

ITEM 90 - WALK IN MEAT COOLER (1 REQ'D)

Kolpak

See shop drawings

1 ea            3 HP warranty - \$426  
                  3/4 HP warranty - \$207  
                  3/4 HP warranty - \$207

ITEM 91 -      WALK IN PRODUCE COOLER (1 REQ'D)  
Kolpak  
See shop drawings

ITEM 92 -      WALK IN FREEZER (1 REQ'D)  
Kolpak  
See shop drawings

ITEM 93 -      PRODUCE AND MEAT COOLER SHELVING (1 It REQ'D)  
Eagle Group

16 ea           Model QPF-2460E-GL-X QuadPLUS™ Shelf Mat, louvered, 60"W x 24"D, green polymer mat with MICROGARD® antimicrobial protection, wire QuadTruss® frame with EAGLEgard® hybrid epoxy finish, (4) split sleeves, NSF (FLYER)  
16 ea           Model QPF-2448E-GL-X QuadPLUS™ Shelf Mat, louvered, 48"W x 24"D, green polymer mat with MICROGARD® antimicrobial protection, wire QuadTruss® frame with EAGLEgard® hybrid epoxy finish, (4) split sleeves, NSF (FLYER)  
32 ea           Model P74-E-X Post, stationary, 74"H, grooved in 1" increments, includes post cap & leveling bolt, EAGLEgard® hybrid epoxy finish with MICROGARD® antimicrobial protection, NSF (FLYER)

ITEM 94 -      DUNNAGE RACK (2 REQ'D)  
Eagle Group Model PD4822-X Dimensions: 12(h) x 48(w) x 22(d)  
Dunnage Rack, polymer, 48"W x 22"D x 12"H, black polyethylene construction, 3000 lb. capacity, NSF (FLYER)

ITEM 95 -      FREEZER SHELVING (1 It REQ'D)  
Eagle Group

12 ea           Model 2448VG-X Shelf, wire, 48"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 800 lbs. capacity, Valu-Gard® green epoxy finish, NSF (FLYER)  
8 ea           Model 2460VG-X Shelf, wire, 60"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 600 lbs. capacity, Valu-Gard® green epoxy finish, NSF (FLYER)  
8 ea           Model 2454VG Shelf, wire, 54"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 600 lbs. capacity, Valu-Gard® green epoxy finish, NSF  
24 ea           Model P74-VG-X Post, stationary, 74"H, grooved in 1" increments, includes post cap & leveling bolt, Valu-Gard® green epoxy finish, NSF (FLYER)  
16 ea           Model A200012 "S"Hook, joins individual wire shelf units end-to-end, back-to-back, or at right angles. (2) required per shelf connection.

ITEM 96 -      DUNNAGE RACK (2 REQ'D)  
Eagle Group Model PD4822-X Dimensions: 12(h) x 48(w) x 22(d)  
Dunnage Rack, polymer, 48"W x 22"D x 12"H, black polyethylene construction, 3000 lb. capacity, NSF (FLYER)

ITEM 97 - DRY STORAGE SHELVING (1 It REQ'D)  
Eagle Group

- 32 ea Model 2460C Shelf, wire, 60"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 600 lbs. capacity, chrome-plated finish, NSF
- 8 ea Model 2448C-X Shelf, wire, 48"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 800 lbs. capacity, chrome-plated finish, NSF (FLYER)
- 40 ea Model CP74-C Caster Post, 74"H, grooved in 1" increments, chrome finish, NSF
- 20 ea Model CSS5-300-X Stem Caster, swivel, 5" wheel diameter, 1-1/4" wheel face, 300 lb. capacity, resilient tread, donut bumper included, EAGLEbrite® zinc, NSF (FLYER)
- 20 ea Model CSB5-300-X Stem Caster with Brake, 5" wheel diameter, 1-1/4" wheel face, 300 lb. capacity, resilient tread, donut bumper included, EAGLEbrite® zinc, NSF (FLYER)

ITEM 98 - DUNNAGE RACK (1 REQ'D)  
Eagle Group Model PD4822-X Dimensions: 12(h) x 48(w) x 22(d)  
Dunnage Rack, polymer, 48"W x 22"D x 12"H, black polyethylene construction, 3000 lb. capacity, NSF (FLYER)

ITEM 99 - CAN RACK (1 REQ'D)  
Eagle Group Model OCR-10-9A-X Dimensions: 71(h) x 25(w) x 35.25(d)  
Panco® Can Rack, full size, mobile design, self feeding gravity fed shelves, designed for (162) #10 or (216) #5 cans, all welded extruded aluminum construction, 4" swivel plate casters, NSF (FLYER)

ITEM 100 - CHEMICAL SHELVING (1 It REQ'D)  
Eagle Group

- 8 ea Model 2460VG Shelf, wire, 60"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 600 lbs. capacity, Valu-Gard® green epoxy finish, NSF
- 4 ea Model 2472VG Shelf, wire, 72"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 600 lbs. capacity, Valu-Gard® green epoxy finish, NSF
- 4 ea Model 2448VG Shelf, wire, 48"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 800 lbs. capacity, Valu-Gard® green epoxy finish, NSF
- 12 ea Model P74-VG Post, stationary, 74"H, grooved in 1" increments, includes post cap & leveling bolt, Valu-Gard® green epoxy finish, NSF
- 16 ea Model A200012 "S"Hook, joins individual wire shelf units end-to-end, back-to-back, or at right angles. (2) required per shelf connection.



***Submittal Sheet***

01/09/2023

**ITEM# 1 - SERVING LINE (1 EA REQ'D)**

RandCus



## ***Submittal Sheet***

01/09/2023

### **ITEM# 1.1 - CONDIMENT ORGANIZER BIN (1 EA REQ'D)**

Cambro 5412CBP480

Organizer Bin, 5"W x 12"D x 4-1/4"H, polyethylene, speckled gray

# VERSA ORGANIZERS

- Use to store non-perishable condiments, disposable ware and napkins.
- Hold bins in 2 x 3, 2 x 4, 3 x 3, or 3 x 4 arrangements.
- Made of seamless, one-piece polyethylene.
- Set on flat surface or wall mount each bin holds up to 10 lbs. (4,5 kg).
- Easy to assemble and easy to clean.

**Bins Only**

Colors: Dark Brown (131), Black (110), Slate Blue (401), Speckled Gray (480).

**Versa Line Combined Pack Bins & Racks**

Colors: Black (110), Speckled Gray (480).



12RS12 Versa Organizer shown mounted on wall.



Bins sold separately (5412CBP) or as combined packs.



12RS12



9RS9



8RS8



6RS6

CODE	DESCRIPTION	PRODUCT DIMENSIONS	CASE PACK
<b>Bins</b>			
5412CBP	Bin only	W x D x H 5" x 12" x 4 1/4"	12
<b>Versa Line Combined Pack</b>			
12RS12	Rack w/12 bins	L x D x H (complete unit) 25 5/8" x 21 3/8" x 14 1/4"	1
9RS9	Rack w/9 bins	20 5/8" x 21 3/8" x 14 1/4"	1
8RS8	Rack w/8 bins	25 5/8" x 17 1/4" x 9 1/4"	1
6RS6	Rack w/6 bins	20 5/8" x 17 1/4" x 9 1/4"	1





## Submittal Sheet

01/09/2023

### ITEM# 2 - HAND SINK (8 EA REQ'D)

Eagle Group BPHS-1014-LRS-NF

BlendPort® Hand Sink, wall-mount, 14"W x 10" front-to-back x 5" deep sink bowl, left & right side splashes with 3" radius at front, basket drain, without faucet, 18 gauge type 304 stainless steel construction, NSF (NET)

#### ACCESSORIES

Mfr	Qty	Model	Spec
T&S Brass	8	B-1115-132X-02	Faucet Workboard, wall mount, 4" centers, 132X gooseneck, B-WH4 handles, quarter-turn Eterna cartridges, low lead, ADA Compliant
T&S Brass	8	B-1100-K	Installation Kit, for workboard wall mount faucets, (2) short EL's

#### WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1	1/2"			1/2"					

#### WASTE

	INDIRECT SIZE	DIRECT SIZE
1		

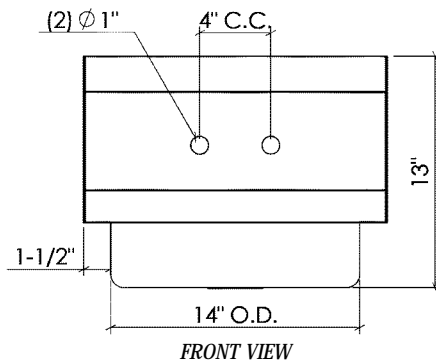
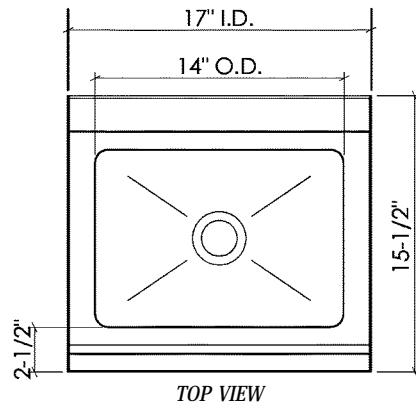


An Eagle Group Company

## Specification Sheet

### Short Form Specifications

BlendPort Hand Sinks with Side Splashes, model \_\_\_\_\_, 18 gauge type 304 stainless steel construction throughout. 10" x 14" x 5" sink bowl. Comes standard with left and right side splashes and basket drain. Offered with or without splash-mount faucet.



## Hand Sinks with Side Splashes

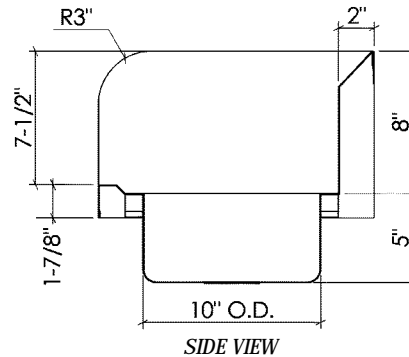
### MODELS:

**BPHS-1014-F-LRS**     **BPHS-1014-LRS-NF**

### Features

- 18 gauge type 304 stainless steel construction.
- Sink bowl is 10" front-to-back, 14" end-to-end, and 5" deep.
- Left and right side splashes with 3" radius at front.
- Basket drain.
- Sink #BPHS-1014-LRS comes with swivel splash-mount gooseneck faucet on 4" center.

model #	description
<b>BPHS-1014-F-LRS</b>	handsink with faucet
<b>BPHS-1014-LRS-NF</b>	handsink without faucet



## BlendPort®

An Eagle Group Company

100 Industrial Boulevard, Clayton, DE 19938-8903 USA

Phone: 800-441-8440 • Fax: 302-653-2065

Printed in U.S.A.

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Certifications / Approvals



BP100.26 Rev. 01/20



**T&S BRASS AND BRONZE WORKS, INC.**

2 Saddleback Cove / P.O. Box 1088  
Travelers Rest, SC 29690

Model No.

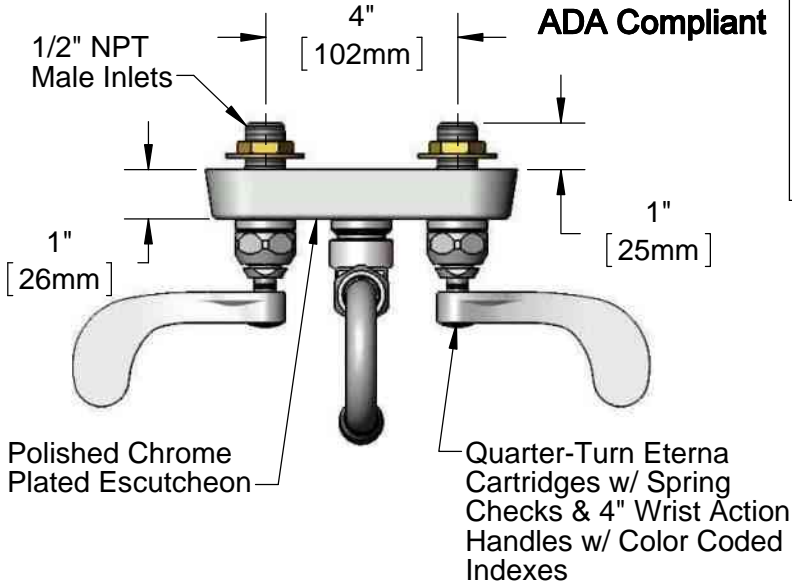
**B-1115-132X-02**

Item No.

Travelers Rest, SC: 800-476-4103 • Simi Valley, CA: 800-423-0150 • Fax: 864-834-3518 • www.tsbrass.com



**ADA Compliant**



This Space for Architect/Engineer Approval

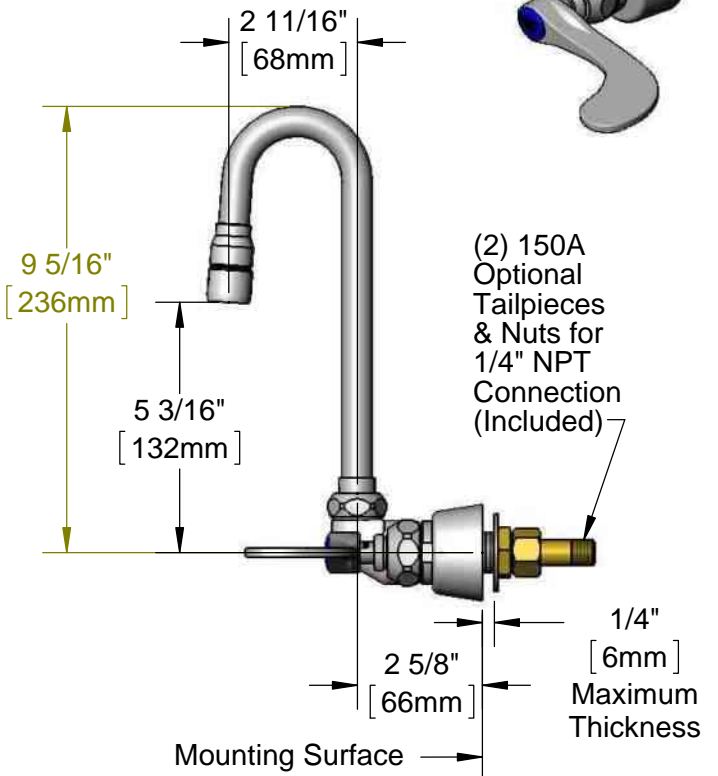
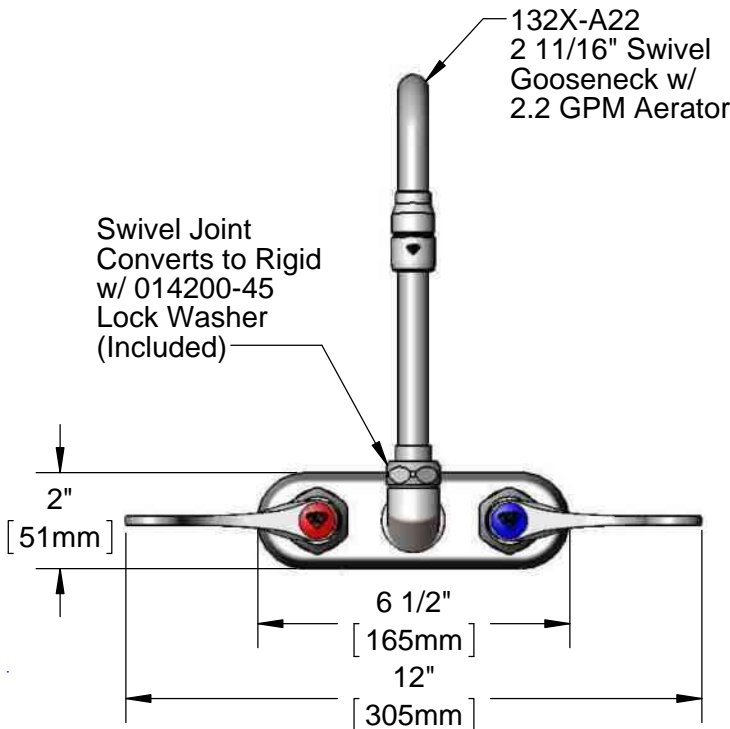
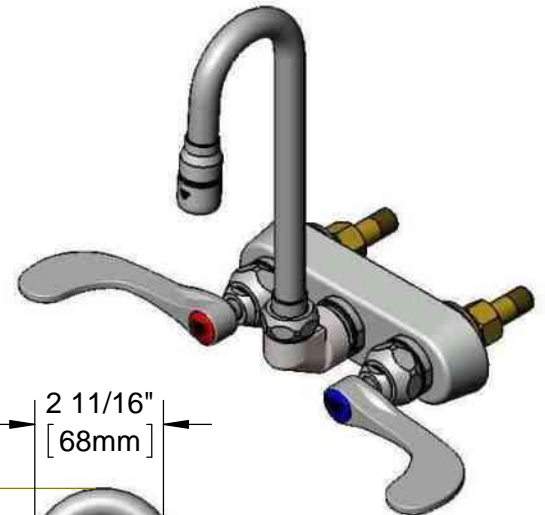
Job Name \_\_\_\_\_ Date \_\_\_\_\_

Model Specified \_\_\_\_\_ Quantity \_\_\_\_\_

Customer/Wholesaler \_\_\_\_\_

Contractor \_\_\_\_\_

Architect/Engineer \_\_\_\_\_



**Rough-In Requirement:**  
(2)  $\varnothing$  1" [25mm] Mounting Holes

**Product Specifications:**  
4" Wall Mount Workboard Faucet, Quarter-Turn Eterna Cartridges w/ Spring Checks, 4" Wrist Action Handles, 2 11/16" Swivel Gooseneck, 2.2 GPM Aerator & 1/2" NPT Male Inlets

**Product Compliance:**  
ASME A112.18.1 / CSA B125.1  
NSF 61 - Section 9  
NSF 372 (Low Lead Content)  
ANSI A117.1 (ADA)



**T&S BRASS AND BRONZE WORKS, INC.**

2 Saddleback Cove / P.O. Box 1088  
Travelers Rest, SC 29690

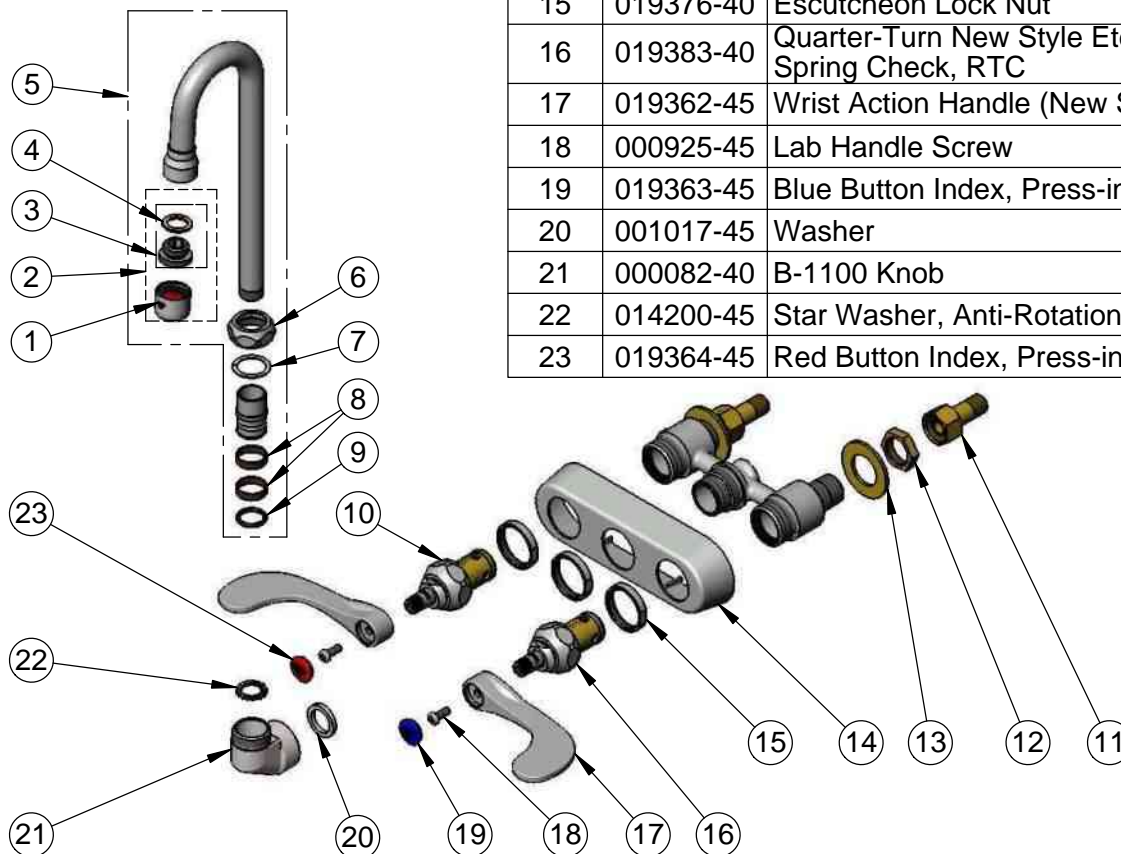
Model No.

**B-1115-132X-02**

Item No.

Travelers Rest, SC: 800-476-4103 • Simi Valley, CA: 800-423-0150 • Fax: 864-834-3518 • www.tsbrass.com

ITEM NO.	SALES NO.	DESCRIPTION
1	B-0199-01	2.2 GPM Aerator, 55/64"-27 UN Female
2	B-0199-02	2.2 GPM Aerator, 3/8" NPSM Male
3	044A	3/8" to Aerator Adapter
4	001043-45	Washer
5	132X-A22	2 11/16" Swivel Gooseneck w/ 2.2 GPM Aerator
6	019360-40	Swivel Nut (New Style)
7	009538-45	Swivel Washer
8	011429-45	Swivel Sleeves (2)
9	001074-45	O-Ring
10	019382-40	Quarter-Turn New Style Eterna Cartridge w/ Spring Check, LTC
11	150A	1/4" NPT Tailpiece & Nut
12	002954-45	Shank Lock Nut
13	000999-45	Brass Lock Washer
14	019374-40	B-1110 Eterna Workboard Escutcheon
15	019376-40	Escutcheon Lock Nut
16	019383-40	Quarter-Turn New Style Eterna Cartridge w/ Spring Check, RTC
17	019362-45	Wrist Action Handle (New Style)
18	000925-45	Lab Handle Screw
19	019363-45	Blue Button Index, Press-in
20	001017-45	Washer
21	000082-40	B-1100 Knob
22	014200-45	Star Washer, Anti-Rotation
23	019364-45	Red Button Index, Press-in



**Product Specifications:**

4" Wall Mount Workboard Faucet, Quarter-Turn Eterna Cartridges w/ Spring Checks, 4" Wrist Action Handles, 2 11/16" Swivel Gooseneck, 2.2 GPM Aerator & 1/2" NPT Male Inlets

**Product Compliance:**

ASME A112.18.1 / CSA B125.1  
NSF 61 - Section 9  
NSF 372 (Low Lead Content)  
ANSI A117.1 (ADA)



# T&S BRASS AND BRONZE WORKS, INC.

2 Saddleback Cove / P.O. Box 1088  
Travelers Rest, SC 29690

Model No.

**B-1100-K**

Item No.

Travelers Rest, SC: 800-476-4103 • Simi Valley, CA: 800-423-0150 • Fax: 864-834-3518 • www.tsbrass.com

This Space for Architect/Engineer Approval

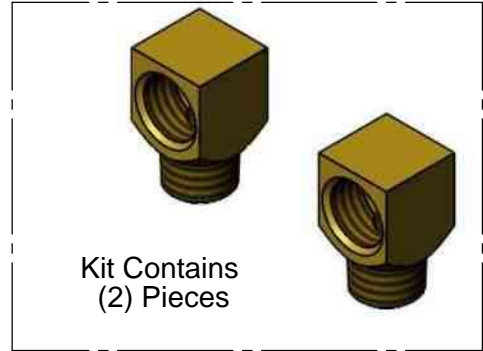
Job Name \_\_\_\_\_ Date \_\_\_\_\_

Model Specified \_\_\_\_\_ Quantity \_\_\_\_\_

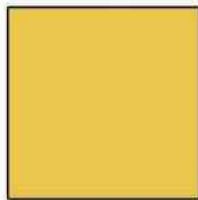
Customer/Wholesaler \_\_\_\_\_

Contractor \_\_\_\_\_

Architect/Engineer \_\_\_\_\_



Kit Contains  
(2) Pieces



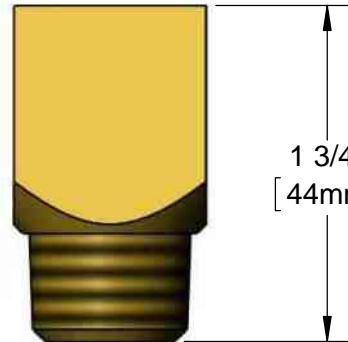
1/2" NPT  
Female Threads



1"  
[25mm]

1 3/4"  
[44mm]

1/2" NPT  
Male Threads



Product Specifications:

1/2" NPT Male x Female Short Elbow Kit

Product Compliance:

ASME A112.18.1 / CSA B125.1  
NSF 61 - Section 9  
NSF 372 (Low Lead Content)



## ***Submittal Sheet***

01/09/2023

### **ITEM# 3 - BUSSING UTILITY TRANSPORT CART, METAL (3 EA REQ'D)**

Eagle Group UC-311

Utility Cart, 3-tier, 16-3/4"W x 27-5/8"D x 32"H, 1" up-turn on sides & rear of top & center shelves, 12-1/2" shelf clearance, (1) push handle, angle legs include bumpers, 300 lbs. capacity, 430 stainless steel all welded construction, 4" swivel plate casters, NSF



Profit from the Eagle Advantage®

## Specification Sheet

### Short Form Specifications

Eagle Stainless Steel Utility Cart, model \_\_\_\_\_.  
Three stainless steel shelves welded to angle legs. Galvanized  
caster channel frame. Available with standard 1"-high  
upturn on ends and rear of top and center shelves, or  
1"-high upturn on all sides of all shelves. Four 4"-diameter  
swivel plate casters. 1"-diameter handle on one end.



"UC" cart with upturns on ends and rear of top and center shelves

Item No.:	_____
Project No.:	_____
S.I.S. No.:	_____

## Stainless Steel Utility Carts

### MODELS:

- UC-311       UUC-311  
 UC-322       UUC-322

### Features on all carts...

- Three 20-gauge stainless steel shelves.
- Type 300 stainless steel shelves.
- 16-gauge stainless steel angle legs.
- Galvanized bottom frame consists of front-to-back caster channels and left-to-right support angles.
- 1" (25mm)-high upturns.
- Each shelf is hemmed for further strength and stability.
- 12½" (318mm) shelf clearance.
- Legs provided with bumpers.
- 4" (76mm)-diameter swivel plate casters.
- 1" (25mm)-diameter handle welded to angle legs.
- Corrosion- and stain-resistant.
- Polished stainless steel finish allows for ease of cleaning and sanitation.
- 500-lb. (226.8 kg) weight capacity.

### EAGLE GROUP

100 Industrial Boulevard  
Clayton, DE 19938-8903 USA

Phone: 302-653-3000 • 800-441-8440

Fax: 302-653-2065

www.eaglegrp.com • www.eaglemhc.com

For custom configuration or fabrication needs, contact our SpecFAB® Division.

Phone: 302-653-3000 • Fax: 302-653-2065 • e-mail: quotes@eaglegrp.com

### Certifications / Approvals



AutoQuotes



EG01.42 Rev. 06/21

Spec sheets available for viewing, printing or downloading from our online literature library at [www.eaglegrp.com](http://www.eaglegrp.com)

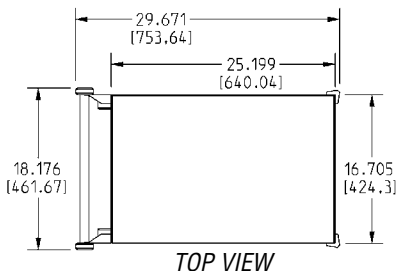
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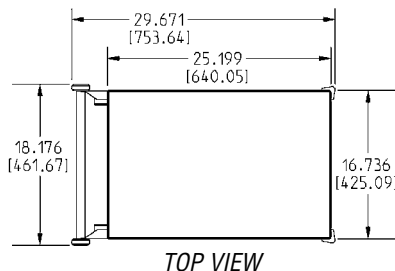
Profit from the Eagle Advantage®

Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

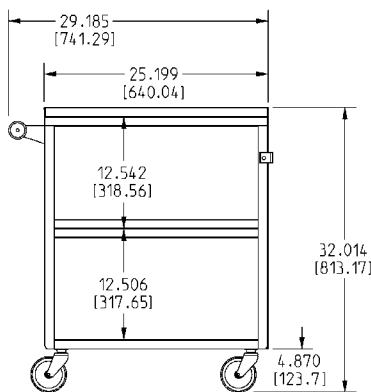
# Stainless Steel Utility Carts



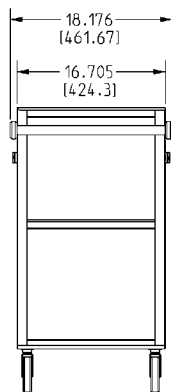
TOP VIEW



TOP VIEW

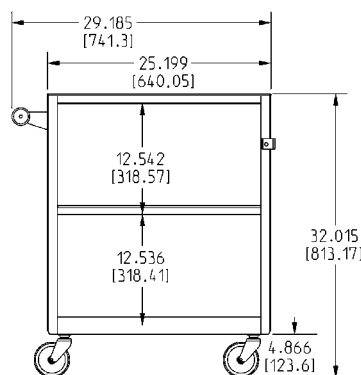


FRONT VIEW

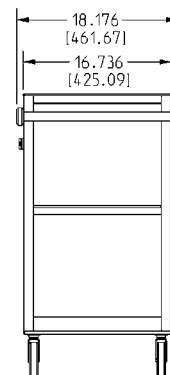


END VIEW

(CART WITH STANDARD UPTURNS SHOWN)



FRONT VIEW



END VIEW

(CART WITH UPTURNS ON ALL SIDES OF ALL SHELVES SHOWN)

## Standard Duty Carts

500-lb. weight capacity.

overall width x length x height		shelf width x length (inner dimensions)		shelf clearance		weight		with * Standard Upturns	with Upturn on all sides of all shelves
in.	mm	in.	mm	in.	mm	lbs.	kg	model #	model #
16 $\frac{3}{4}$ " x 29 $\frac{1}{2}$ " x 32"	426 x 753 x 813	16 $\frac{1}{2}$ " x 25 $\frac{5}{16}$ "	419 x 643	12 $\frac{1}{2}$ "	318	29	13.2	UC-311	UUC-311
19" x 33" x 32"	483 x 838 x 813	18 $\frac{3}{4}$ " x 28 $\frac{11}{16}$ "	476 x 729	12 $\frac{1}{2}$ "	318	32	14.5	UC-322	UUC-322

\* Upturn on sides and rear of top and center shelves.

## EAGLE GROUP

100 Industrial Boulevard, Clayton, DE 19938-8903 USA  
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### Submittal Sheet

01/09/2023

**ITEM# 4 - PASS-THRU REFRIGERATOR (2 EA REQ'D)**

Delfield GARPT2P-SH

Specification Line® Refrigerator, Pass-Thru, two-section, 50.0 cubic feet capacity, top-mounted self-contained refrigeration system, (8) half-height hinged solid doors (locking), (6) adjustable chrome wire shelves, 4.3" easyTouch® screen temperature display/control with remote monitoring, LED interior lighting, stainless steel exterior front, sides & interior, (4) 5" locking casters, GreenGenius™ R290 Hydrocarbon refrigerant, 0.38 HP, 115v/60/1-ph, 6.5 amps, NEMA 5-15P, NSF, cULus, ENERGY STAR®

**ACCESSORIES**

Mfr	Qty	Model	Spec
Delfield	2		Introducing: Freight Made Simple  6% on Single purchase orders shipping to one location**. Liftgate & inside delivery not included. Nationwide Freight*  *Continental United States only  **6% Must be manually calculated on your purchase order total, \$200 minimum.  If you have any questions, please contact Customer Service at 1-800-733-8948
Delfield	2	0460003CN	3 year parts & labor warranty, standard
Delfield	2	W00003ACN	Additional 4 years compressor warranty (parts only), standard
Delfield	2		Left door hinged on left, right door hinged on right, standard (Thermometer side)
Delfield	2		Left door hinged on left, right door hinged on right, standard (Rear)
Delfield	2		Set of (4) 5" locking casters, standard

### ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	115	60	1	Cord & Plug		5-15P	6.5		0.38		



Project \_\_\_\_\_  
 Item \_\_\_\_\_  
 Quantity \_\_\_\_\_  
 CSI Section 11400  
 Approved \_\_\_\_\_  
 Date \_\_\_\_\_

# GARPTP Pass-Thru

## Specification Line® Pass-Thru Refrigerators

GARPTP Pass-Thru

### Models

- GARPT1P-S       GARPT2P-S  
 GARPT1P-SH       GARPT2P-SH



GARPT1P-SH

### Standard Features

- GreenGenius™ R290 top mount refrigeration system featuring TXV expansion valve and hot gas condensate removal
- easyTouch Control with remote monitoring capability
- Digital exterior temperature display with high/low temp visual alarms
- Energy saving LED interior light
- Removable side louver
- Accommodates full size sheet pans
- Raised ABS interior door liner
- Smart door hinge that auto closes up to 90° and stays open past 90°
- Patented, lifetime warranty integral door handle
- Energy efficient door gasket – removable without tools
- Door locks
- 5" locking casters shipped loose for field installation
- 10' cord and plug attached
- Stainless steel exterior front, sides & interior
- Field rehingable doors - full height doors only
- Stainless steel pilaster with shelf clips
- 3 shelves per section
  - Chrome standard
- 115V / 60C / 1 P Standard
- Three year parts and labor warranty and an additional 2 year compressor parts warranty.

### Options

- 6" Stainless steel feet
- 6" Casters (all locking)
- 6" Stainless Steel flanged feet
- Additional chrome shelves
- Stainless steel shelves
- S/S finish door liner
- Tray/Pan Slides – various
- Utility base
- Kick plate
- Laminate – front, ends, shroud
- Heat shield end – max temp 400 degrees
- Trim strips
- Foot Pedal Door Opener

### Specifications

**Refrigeration system:** All components are mounted to the top cabinet ceiling, outside the food zone and are assembled as one piece and can be removed as one piece. Environmentally friendly R290 refrigerant is used. System has the capability of maintaining between 33°F and 40°F in heavy use food service operations. Refrigerant is metered using a highly responsive thermostatic expansion valve. System is controlled using an electronic temperature control, which provides improved pull down times, reducing compressor cycling and longer compressor life with lower energy consumption. Control system uses adaptive defrost to assure evaporator coil is free of ice and operating at optimum efficiency. Evaporator

condensate is eliminated using an energy efficient hot gas system.

Units are completely insulated with high density foamed in place environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane.



980 S. Isabella Rd.  
 Mt. Pleasant, Michigan 48858

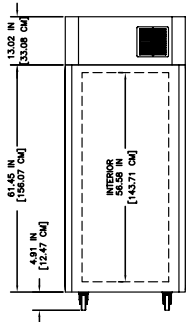
Phone: 800-733-8948 or 989-773-7981  
 Fax: 800-669-0619  
 www.delfield.com

www.delfield.com  
 6623\_DEL\_GARPTP-S  
 06/18

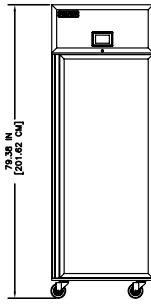




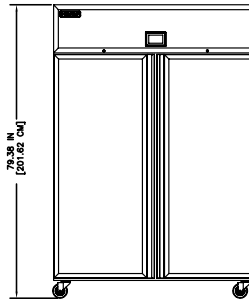
GARPTP Pass-Thru



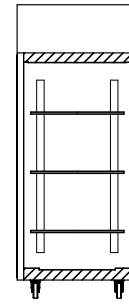
TYP. LEFT END VIEW



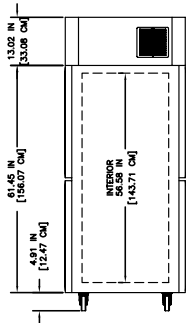
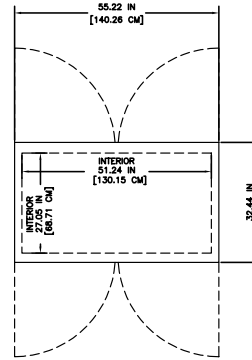
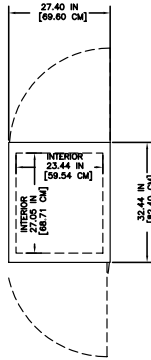
GARPT1P-S



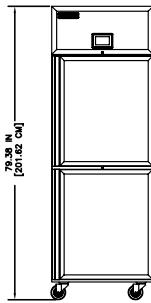
GARPT2P-S



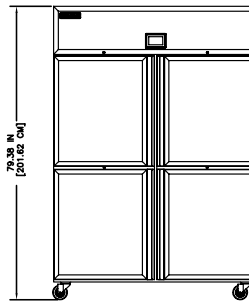
SECTION VIEW



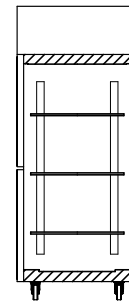
TYP. LEFT END VIEW



GARPT1P-SH



GARPT2P-SH



SECTION VIEW

Specifications									
Model	V/Hz/Ph	Amps	Volume Cu. Ft.	SHELF CAPACITY SQ. FT.	No. of Shelves	Unit H.P.	Btu/Hr System Cap	Ship Weight	Nema Plug
GARPT1P-S GARPT1P-SH	115/60/1	4.2	23	12.12	3	0.22	1799	448	5-15P
GARPT2P-S GARPT2P-SH	115/60/1	6.5	50	26.5	6	0.38	3320	652	5-15P

Welbilt reserves the right to make changes to the design or specifications without prior notice.

980 S. Isabella Rd.  
Mt. Pleasant, Michigan 48858

Phone: 800-733-8948 or 989-773-7981  
Fax: 800-669-0619  
www.delfield.com

www.delfield.com  
6623\_DEL\_GARPTP-S  
06/18





**Submittal Sheet**

01/09/2023

**ITEM# 5 - PASS-THRU HEATED CABINET (1 EA REQ'D)**

Delfield GAHPT2-S

Specification Line® Heated Cabinet, Pass-Thru, two-section, 50.0 cubic feet capacity, (4) full-height hinged solid doors (locking), (6) adjustable chrome wire shelves, 4.3" easyTouch® screen temperature display/control with remote monitoring, incandescent interior lighting, stainless steel exterior front, sides & interior, (4) 5" locking casters, 208-240v/60/1-ph, 10.5 amps, NEMA 6-20P, NSF, cULus

**ACCESSORIES**

Mfr	Qty	Model	Spec
Delfield	1		Introducing: Freight Made Simple  6% on Single purchase orders shipping to one location**. Liftgate & inside delivery not included. Nationwide Freight*  *Continental United States only  **6% Must be manually calculated on your purchase order total, \$200 minimum.  If you have any questions, please contact Customer Service at 1-800-733-8948
Delfield	1	0460003CN	3 year parts & labor warranty, standard
Delfield	1		Left door hinged on left, right door hinged on right, standard (Thermometer side)
Delfield	1		Left door hinged on left, right door hinged on right, standard (Rear)
Delfield	1		(Front) Full height solid door, standard
Delfield	1		(Front) Full height solid door, standard
Delfield	1		(Rear) Full height solid door, standard
Delfield	1		(Rear) Full height solid door, standard
Delfield	1		Set of (4) 5" locking casters, standard

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	208-240	60	1	Cord & Plug		6-20P	10.5				



Project \_\_\_\_\_  
 Item \_\_\_\_\_  
 Quantity \_\_\_\_\_  
 CSI Section 11400  
 Approved \_\_\_\_\_  
 Date \_\_\_\_\_

# GAHPT Pass-Thru

## Specification Line® Heated Pass-Thru

GAHPT Pass-Thru

### Models

- GAHPT1-S       GAHPT2-S  
 GAHPT1-SH       GAHPT2-SH



GAHPT1-S

### Standard Features

- easyTouch Control with remote monitoring capability
- Digital exterior temperature display with high/low temp visual alarms
- Removable side louver
- Accommodates full size sheet pans
- Stainless steel interior door liner
- Smart door hinge that auto closes up to 90° and stays open past 90°
- Patented, lifetime warranty integral door handle
- Energy efficient door gasket – removable without tools
- Door locks
- 40 watt incandescent light
- 5" locking casters shipped loose for field installation
- 10' cord and plug attached
- Stainless steel exterior front, sides & interior
- Field rehingable doors - full height doors only
- Stainless steel pilaster with shelf clips
- 3 shelves per section
  - Chrome standard
- Three year parts and labor warranty

### Options & Accessories

- 6" Stainless steel feet
- 6" Casters (all locking)
- 6" Stainless Steel flanged feet
- Additional chrome shelves
- Stainless steel shelves
- Tray/Pan Slides – various
- Utility base
- Kick plate
- Laminate – front, ends, shroud
- Heat shield end – max temp 400 degrees
- Trim strips
- Foot Pedal Door Opener

### Specifications

**Heating system:** Cabinets are designed to maintain temperatures between 120°F and 200°F. Heating elements are located behind the vertical ducts. The design of the heater, which is full length of the vertical duct, allows for optimal air flow and energy efficiency. Fan motor is mounted outside of the heated compartment. System is controlled using an electronic temperature control.

Units are completely insulated with high density foamed in place environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane.



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 Mt. Pleasant, Michigan 48858

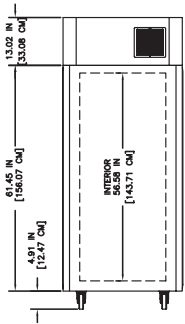
Phone: 800-733-8948  
 Fax: 800-669-0619

[www.delfield.com](http://www.delfield.com)  
 6624\_DEL\_GAHPT-S  
 06/18

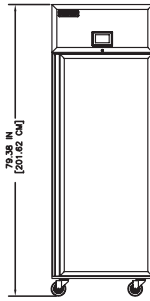




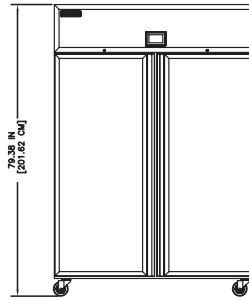
GAHPT Pass-Thru



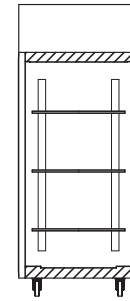
TYP. LEFT END VIEW



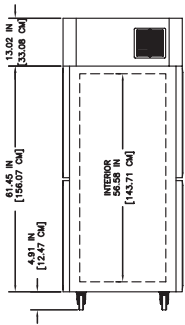
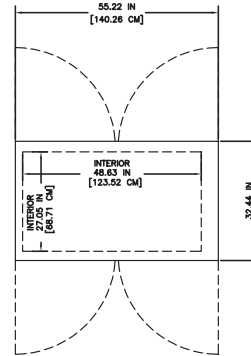
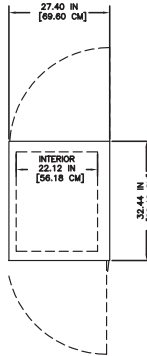
GAHPT1-S



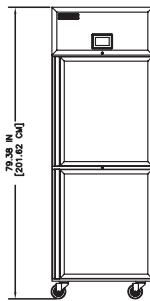
GAHPT2-S



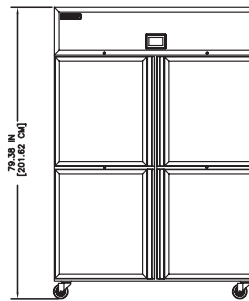
SECTION VIEW



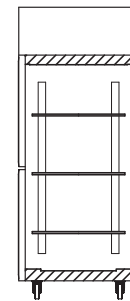
TYP. LEFT END VIEW



GAHPT1-SH



GAHPT2-SH



SECTION VIEW

Specifications								
Model	V/Hz/Ph	Amps	Volume Cu. Ft.	SHELF CAPACITY SQ. FT.	No. of Shelves	Unit H.P.	Ship Weight	Nema Plug
GAHPT1-S GAHPT1-SH	208-240/60/1	6	23	11.5	3	N/A	330	6-20P
GAHPT2-S GAHPT2-SH	208-240/60/1	10.5	50	25.5	6	N/A	630	6-20P

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Mt. Pleasant, Michigan 48858

Phone: 800-733-8948  
Fax: 800-669-0619

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**Submittal Sheet**

01/09/2023

**ITEM# 6 - BEVERAGE DISPENSER, COLD BREW AND COFFEE (1 EA REQ'D)**

BUNN 38800.0000

38800.0000 LCA-2 LP Liquid Coffee Dispenser, ambient, low profile, 2 dispense heads, Scholle 1910LX connector, bag-in-box capacity (2) .05 gallon, dispense ratio 25:1 up to 100:1, refill or rinse LED lights, black, 4" adjustable plastic legs, 120v/60/1-ph, 12 amps, 1440 watts, cord attached, UL, NSF

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	120	60	1				12	1.44			

**WATER**

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1				3/8"					

**WASTE**

	INDIRECT SIZE	DIRECT SIZE
1		

# LCA-2 LP (w/ Scholle 1910LX)

23.2" x 20.9" x 15.8"  
(58.9cm x 53.1cm x 40.1cm)

- Accommodates two 1/2gal (1.9L) bag-in-box (BIB) containers
- Attractive appearance with shorter profile
- Serves two coffee products and hot water
- Set up for continuous dispense (by the cup) for self-serve applications or portion control to fill cups or carafes
- Refill or rinse LED lights alert the operator for concentrate or cleaning



 Servers and airpots sold separately

Agency:



## Specifications

**Product #:** 38800.0000

**Product Ratio:** 25:1-100:1

**Connector:** Scholle 1910LX

**Water Access:** Plumbed

**Finish:** Black

## Additional Features

## Electrical & Capacity

Volts	Amps	Watts	Cord Attached	Plug Type	8oz cups/hr 236ml cups/hr	Input H <sub>2</sub> O Temp.	Phase	# Wires plus Ground	Hertz
120	12	1440	Yes	NEMA 5-15P	765	60°F (15.5°C)	1	2	60

## Plumbing Requirements

PSI	kPa	Fitting Supplied	Water Flow Required (GPM)
20-90	138-621	1/4" Male Flare Fitting	-

## CAD Drawings

2D	Revit	KLC
●		

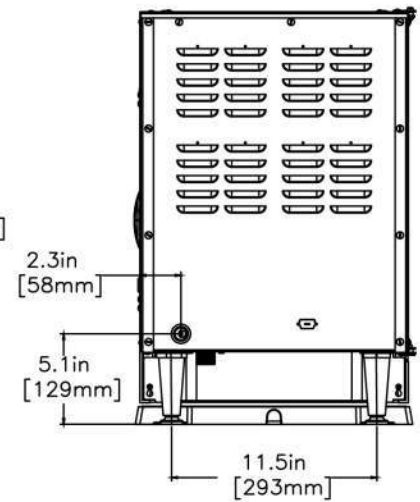
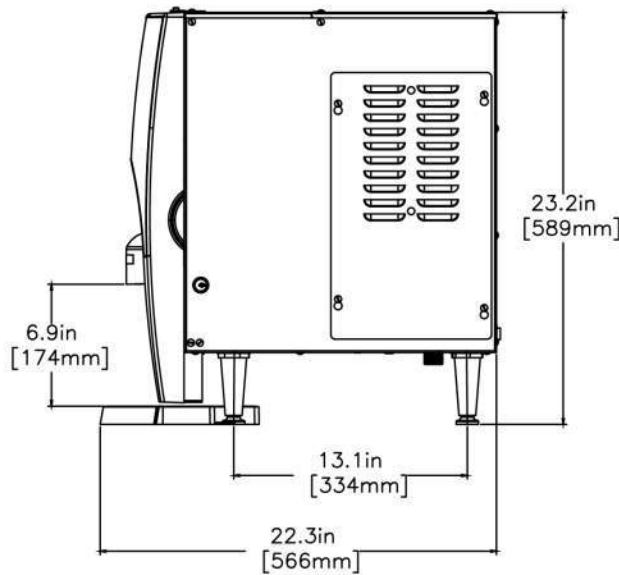
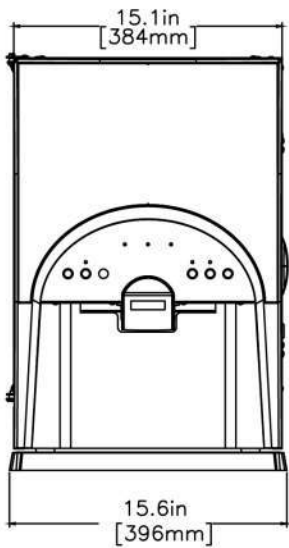
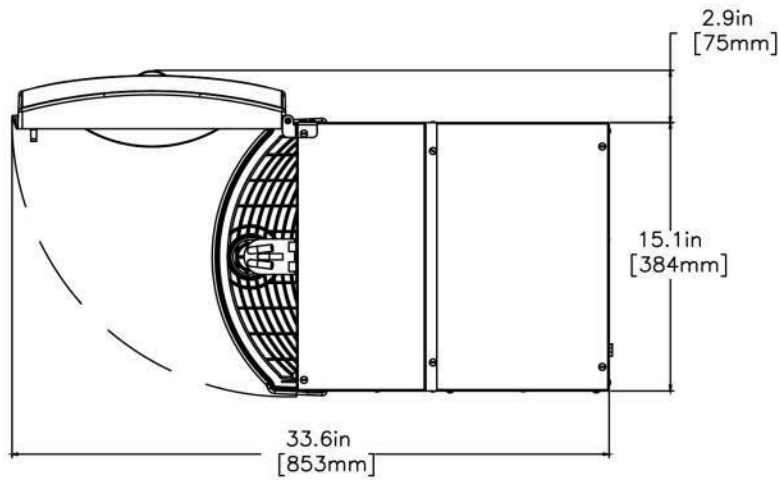


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Created on:  
06/15/2017

For most current specifications and other info visit [bunn.com](http://bunn.com).





Unit			Shipping					
	Width	Height	Depth	Width	Height	Depth	Weight	Volume
English	15.8 in.	23.2 in.	20.9 in.	-	-	-	66.460 lbs	-
Metric	40.1 cm	58.9 cm	53.1 cm	-	-	-	30.146 kgs	-



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## Related Products & Accessories:LCA-2 LP (w/ Scholle 1910LX)(38800.0000)



KIT,DISPENSE RATIO  
CAL LCA/LCC

Product #: 34843.1000

KIT, DRIP TRAY DRAIN

Product #: 37309.0000

PUMP TUBE ASSY,LP  
W/1/8" TUBE

Product #: 37942.1000

ADPTR/TUBE PKG, W/  
SCHOLLE 1910 & 1/8"

Product #: 38800.0200

ADPTR/TUBE PKG,W/  
QCDII & 1/8"

Product #: 38800.0201

ADPTR/TUBE PKG,  
SCHOLLE-Q/C 1/8"

Product #: 38800.0202



WATER FILTER,  
EQHP-10L

Product #: 39000.0001



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***Submittal Sheet***

01/09/2023

**ITEM# 7 - BEVERAGE TABLE (1 EA REQ'D)**

Randell



***Submittal Sheet***

01/09/2023

**ITEM# 8 - TRAY CONVEYOR (1 EA REQ'D)  
(HOBART)**



## Submittal Sheet

01/09/2023

### ITEM# 9 - EYE WASH STATION (1 EA REQ'D)

Chicago Faucets 8401-NF

Eye/Face Wash, wall mount, push handle for activation, drench shower fitting, 1/2" NPT female thread inlet, eyewash assembly in ABS plastic, eyewash bow in stainless steel, brass fittings with galvanized pipe construction

#### ACCESSORIES

Mfr	Qty	Model	Spec
Chicago Faucets	1		Ships 5 business days from order acknowledgement

### WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1	1-1/2"			1-1/2"					

### WASTE

	INDIRECT SIZE	DIRECT SIZE
1		

# Safety Fittings 8401-NF



Geberit Group

## Product Type

---

Safety eye/face wash, drench shower fitting

## Features & Specifications

---

## Performance Specification

---

## Warranty

---

- 1-Year Limited Finish Warranty
- 1-Year Limited Material Warranty

## Codes & Standards

---

- **WARNING:** This product can expose you to lead, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to [www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov).

Job Name \_\_\_\_\_

Item Number \_\_\_\_\_

Section/Tag \_\_\_\_\_

Model Specified \_\_\_\_\_

Architect \_\_\_\_\_

Engineer \_\_\_\_\_

Contractor \_\_\_\_\_

Submitted as Shown       Submitted with Variations

Date \_\_\_\_\_



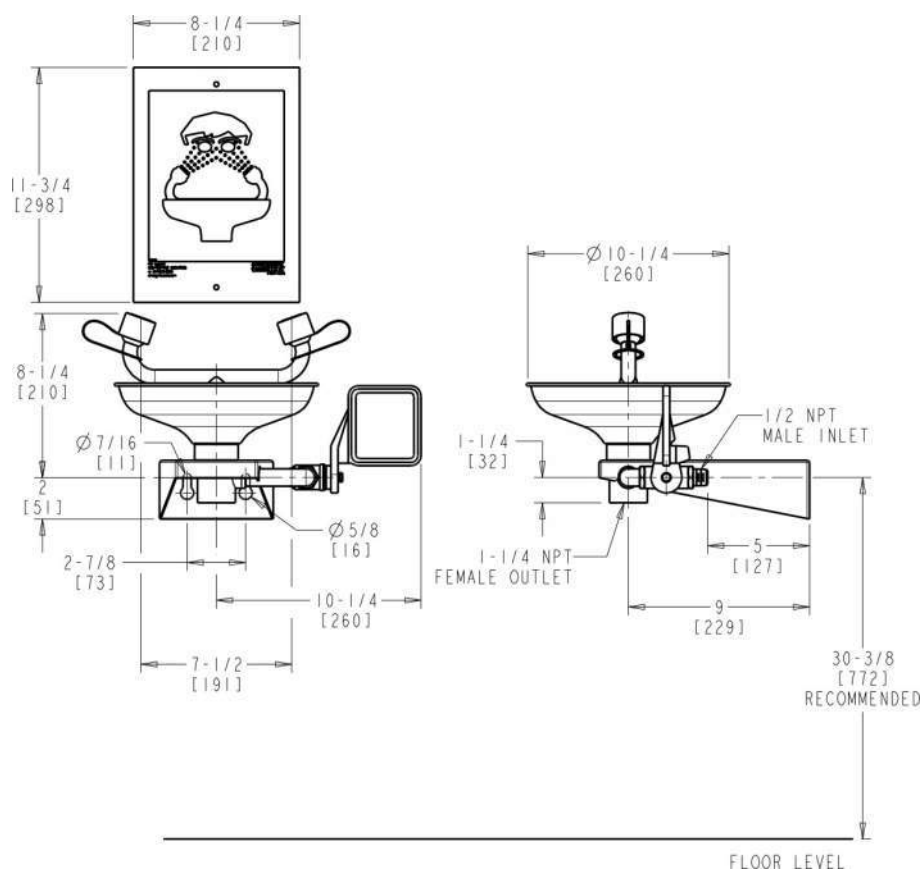
## 8401-NF

**CHICAGO  
FAUCETS**


Geberit Group

## Architect/Engineer Specification

Chicago Faucets No. 8401-NF, Eye Face Wash with 1/2" NPT Female Thread Inlet, Anti-corrosive polyamide 11 plastic coating in high-visibility yellow color, Eyewash assembly in ABS plastic, Eyewash bowl in stainless steel, Two high-flow aerated water spray at low pressure with automatic opening anti-dust cover, Wall Mounted, Brass Fittings with Galvanized Pipe Construction, Push Handle for activation, High-visibility photoluminescence safety sign with green background and white text for easy identification, Maintenance card for recording periodic testing and Certified to the ANSI Z358.1 Standard for Emergency Eyewash and Shower Equipment.



## Operation and Maintenance

Installation should be in accordance with local plumbing codes. Flush all pipes thoroughly before installation. After installation, remove spout outlet or flow control and flush faucet thoroughly to clear any debris. Care should be taken when cleaning the product. Do not use abrasive cleaners, chemicals or solvents as they can result in surface damage. Use mild soap and warm water for cleaning and protecting the life of Chicago Faucet products. For specific operation and maintenance refer to the installation instructions and repair parts documents that are located at [www.chicagofaucets.com](http://www.chicagofaucets.com).

Chicago Faucets, member of the Geberit Group, is the leading brand of commercial faucets and fittings in the United States, offering a complete range of products for schools, laboratories, hospitals, office buildings, food service, airports and sport facilities. Call 1.800.TECTRUE or 1.847.803.5000 Option 1 for installation or other technical assistance.



2100 South Clearwater Drive  
Des Plaines, IL  
P: 847/803-5000  
F: 847/803-5454  
Technical: 800/TEC-TRUE  
[www.chicagofaucets.com](http://www.chicagofaucets.com)



## Thermostatic/Pressure Balance Shower With Automatic Drain

This system is designed to help reduce the growth of pathogens in the shower system by reducing stagnant water in the shower valve, pipes and hoses of the shower system. Drains integrated into the valve and hand spray hose automatically flush water out of the system after each use.

- ① **Thermostatic/Pressure Balancing Shower Valve**  
Provides protection from scalding and thermal shocks by monitoring both the water temperature and pressure.
- ② **Automatic Valve Drain**  
Available integrated into the round trim or as a separate drain installed below the valve. When the water is shut off, water drains automatically from the valve.
- ③ **Automatic Hand Spray Hose Valve**  
The valve is integrated into the hose. After each use, water from the spray and hose is drained automatically.

### Valve and Trim with Integrated Drain



Valve Only	1921-VONF
Valve with Trim Kit	1921-VOCCP
Trim Kit Only	SH-TK4-00-000

### Valve and Trim with Separate Drain



Works with 1920-VONF valve and trim options on previous two pages.

Drain Wall Elbow	1920-039KCP
Wall Drain	1920-028KCP

### Adjustable Spray Shower Head

2.5 GPM

Shower Valve with Shower Head



SH-TP4-01-000

### Tamper Resistant Shower Head

2.5 GPM

Shower Valve with Shower Head



SH-TP4-04-000





## ***Submittal Sheet***

01/09/2023

### **ITEM# 10 - DISHTABLE SORTING SHELF (1 EA REQ'D)**

Eagle Group 605381-X

Slanted Rack Shelf, solid, wall mount, 42"W x 21"D x 21-3/8"H, drip tube on left side, 16/304 stainless steel (FLYER)



Profit from the Eagle Advantage®

## Specification Sheet

### Short Form Specifications

Eagle Wall-Mounted Slanted Rack Shelf, model \_\_\_\_\_ constructed of 16/304 stainless steel, with stainless steel wall brackets and drip tube.

Eagle Table-Mounted Double Sided Shelf, model \_\_\_\_\_ for use with landing shelf of dishtable, or with soiled dishtables with center island design. 1" O.D. 16/304 stainless steel tubular uprights on one end, and one end wall-mounted. Available as solid "Rack" shelf with type 304 stainless steel construction, or as "Sorting" Shelf with 1½" diameter full-length tubing.

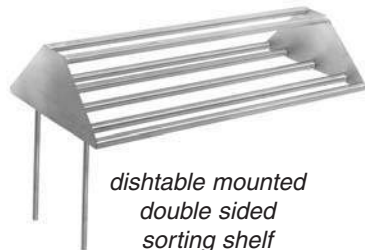
Eagle Wall-Mounted Tubular Rack Shelf, model \_\_\_\_\_ with ends constructed of 14/304 stainless steel, and 1½" diameter full-length tubing. Available with all-welded or knocked-down construction.



wall mounted  
slanted rack shelf



dishtable mounted  
double rack shelf



dishtable mounted  
double sided  
sorting shelf



tubular rack shelf

### EAGLE GROUP

100 Industrial Boulevard, Clayton, DE 19938-8903 USA

Phone: 302-653-3000 • Fax: 302-653-2065

www.eaglegrp.com

Foodservice Division: Phone 800-441-8440

MHC/Retail Display Divisions: Phone 800-637-5100

For custom configuration or fabrication needs, contact our SpecFAB® Division.

Phone: 302-653-3000 • Fax: 302-653-3091 • e-mail: specfab@eaglegrp.com



EG50.06 Rev. 06/09

Spec sheets available for viewing, printing or downloading from our online literature library at [www.eaglegrp.com](http://www.eaglegrp.com)

Eagle Foodservice Equipment, Eagle MHC, SpecFAB®, and Retail Display are divisions of Eagle Group. ©2009 by the Eagle Group

Item No.: \_\_\_\_\_  
Project No.: \_\_\_\_\_  
S.I.S. No.: \_\_\_\_\_

## Dishtable Rack Shelves

### MODELS:

605380

606643

606302

605381

606644

606303

605382

605383

606296

606294

606295

606297

606641

606300

606298

606642

606301

606299

### Slanted Rack Shelves

- Shelves provide extra rack storage.
- 16 gauge stainless steel construction.
- Wall mounting brackets included.
- Complete with drip tube on left or right side.

### Double Rack Shelf

- For use with soiled dishtable with landing shelf and soiled dishtables with center island design.
- 60" (1524mm) long.
- Please note that one end is wall-mounted.
- Drip tubes on wall-mounted end.

### Double Sided Sorting Shelf

- For use with soiled dishtables with landing shelf and soiled dishtables with center island design.
- 60" (1524mm) long.
- Features 1½" (41mm)-diameter full-length tubing.
- Please note that one end is wall-mounted.

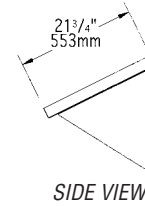
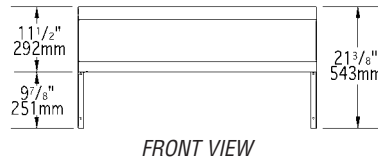
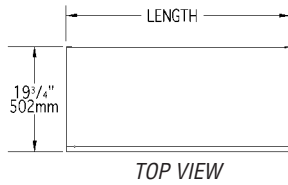
### Tubular Design Rack Shelves

- Wall mounted.
- Features 1½" (41mm)-diameter full-length tubing.
- Models #606300-606303 feature all-welded construction.
- Models #606296-606299 feature knock-down construction.



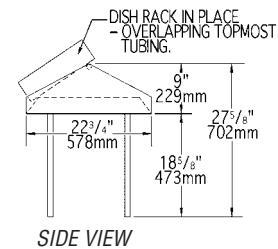
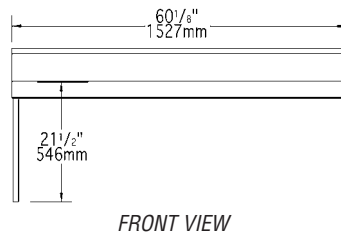
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 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

### Slanted Rack Shelves



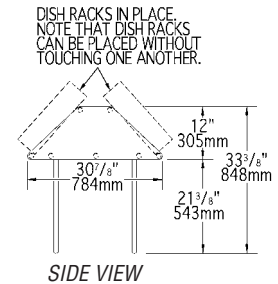
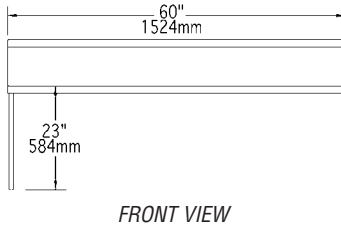
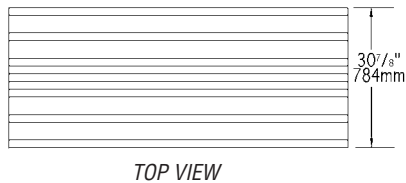
TUBE ON LEFT		TUBE ON RIGHT		width		length		weight	
model #	model #	in.	mm	in.	mm	lbs.	kg		
605380	606641	21"	533	21"	533	20	9.0		
605381	606642	21"	533	42"	1067	30	13.6		
605382	606643	21"	533	63"	1600	40	18.1		
606294	606644	21"	533	84"	2134	50	22.7		

### Double Rack Shelf



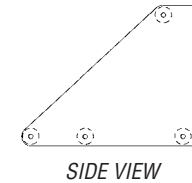
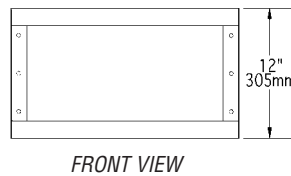
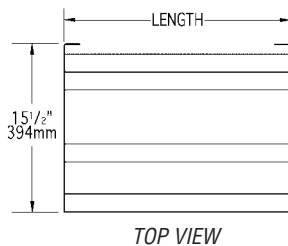
model #	weight	lbs.	kg
605383	61	27.7	

### Double Sided Sorting Shelf



model #	weight	lbs.	kg
606295	75	34.0	

### Tubular Design Rack Shelves



ALL-WELDED MODELS			KNOCK-DOWN MODELS			length	
model #	weight		model #	weight		in.	mm
606300	16	7.3	606296	17	7.7	21"	533
606301	25	11.3	606297	26	11.8	42"	1067
606302	34	15.4	606298	35	15.9	63"	1600
606303	43	19.5	606299	44	20.0	84"	2134

#### EAGLE GROUP

100 Industrial Boulevard, Clayton, DE 19938-8903 USA

Phone: 302-653-3000 • Fax: 302-653-2065 • www.eaglegrp.com

Foodservice Division: Phone 800-441-8440

MHC/Retail Display Divisions: Phone 800-637-5100

Spec sheets available for viewing, printing or downloading from our online literature library at [www.eaglegrp.com](http://www.eaglegrp.com)

Although every attempt has been made to ensure the accuracy of the information provided, we cannot be held responsible for typographical or printing errors. Information and specifications are subject to change without notice. Please confirm at time of order.



## Submittal Sheet

01/09/2023

### ITEM# 11 - PRE-RINSE FAUCET ASSEMBLY (1 EA REQ'D)

T&amp;S Brass B-0133-CR-B08

EasyInstall Pre-Rinse Unit, 8" wall mount, 44" flex hose, 6" wall bracket, 18" riser, overhead spring, ceramic cartridge, lever handle, 1.07 GPM spray valve, 1/2" NPT, EPAAct2005 compliant, (B-0108)

### ACCESSORIES

Mfr	Qty	Model	Spec
T&S Brass	1	B-0230-K	Installation Kit, (2) 1/2" NPT nipples, lock nuts & washers, (2) short "EII" 1/2" NPT female x male

### WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1	1/2"			1/2"					

### WASTE

	INDIRECT SIZE	DIRECT SIZE
1		



**T&S BRASS AND BRONZE WORKS, INC.**

2 Saddleback Cove / P.O. Box 1088  
Travelers Rest, SC 29690

Model No.

**B-0133-CR-B08**

Item No.

Travelers Rest, SC: 800-476-4103 • Simi Valley, CA: 800-423-0150 • Fax: 864-834-3518 • www.tsbrass.com

This Space for Architect/Engineer Approval

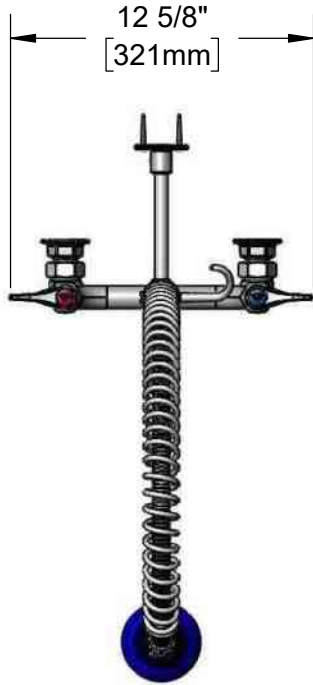
Job Name \_\_\_\_\_ Date \_\_\_\_\_

Model Specified \_\_\_\_\_ Quantity \_\_\_\_\_

Customer/Wholesaler \_\_\_\_\_

Contractor \_\_\_\_\_

Architect/Engineer \_\_\_\_\_



44" Flexible Stainless Steel Hose w/ Spring & Spray Valve

Items Not Shown for Clarity

Finger Hook

3/8" NPT x 18" Riser

EasyInstall Lock Nut & Bushing

Quarter-Turn Cerama Cartridges w/ Check Valves & Lever Handles w/ Color Coded Indexes

B-0109-01 6" Wall Bracket

B-0108 1.07 GPM Spray Valve

3 11/16" [93mm]

5 3/8" [137mm]

33 3/8" [848mm]

8" [203mm]

Adjustable From 7 3/4" to 8 1/4" [197mm to 210mm]

Ø2" [51mm] Flanges w/ 1/2" NPT Female Inlets

14 7/16" [366mm]

2 3/8" [61mm]

Mounting Surface

Product Specifications:

Pre-Rinse Unit: EasyInstall 8" Wall Mount Mixing Faucet, Quarter-Turn Cerama Cartridges w/ Check Valves, Lever Handles, 44" Flexible Stainless Steel Hose, 1.07 GPM Spray Valve, 6" Wall Bracket & 1/2" NPT Female Inlets

Product Compliance:

ASME A112.18.1 / CSA B125.1  
NSF 61 - Section 9  
NSF 372 (Low Lead Content)  
2019 DOE PRSV - Class II



**T&S BRASS AND BRONZE WORKS, INC.**

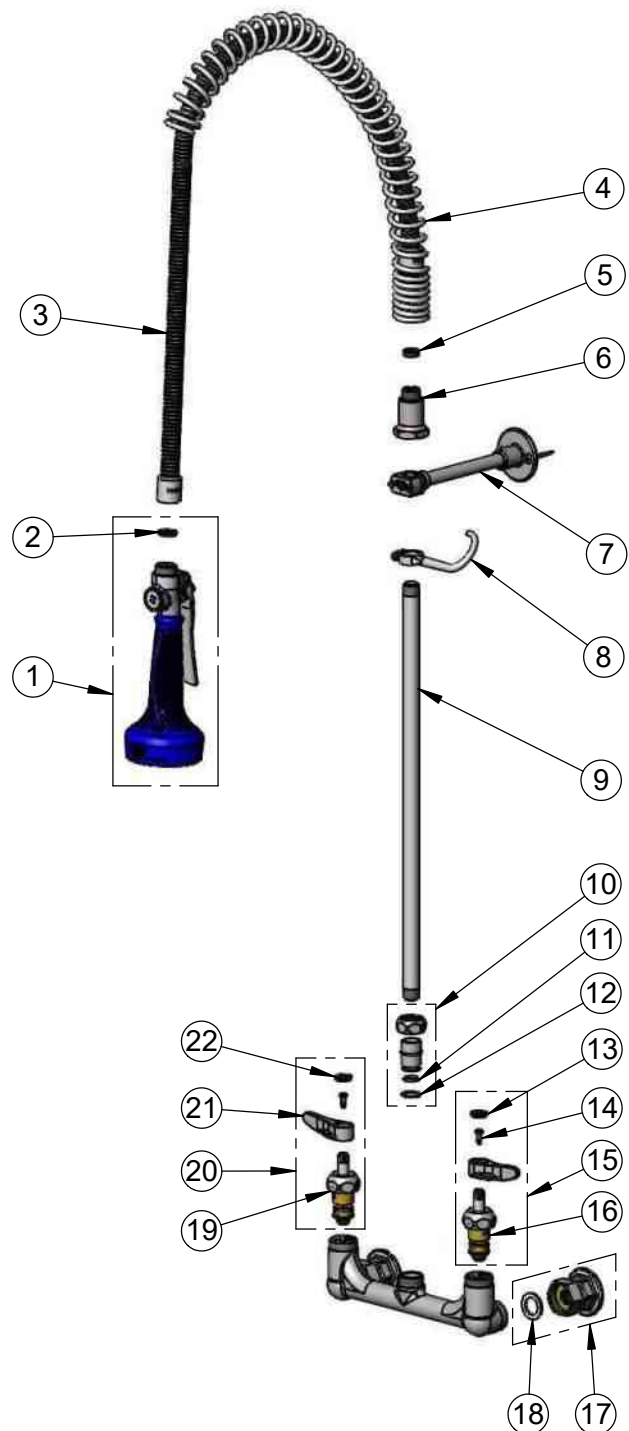
2 Saddleback Cove / P.O. Box 1088  
Travelers Rest, SC 29690

Model No.

**B-0133-CR-B08**

Item No.

Travelers Rest, SC: 800-476-4103 • Simi Valley, CA: 800-423-0150 • Fax: 864-834-3518 • www.tsbrass.com



ITEM NO.	SALES NO.	DESCRIPTION
1	B-0108	1.07 GPM Spray Valve w/ Ergo-Grip
2	001014-45	Washer, B-0100 Hose Barrel
3	B-0044-H2A	44" Flexible Stainless Steel Hose, Less Handle
4	000888-45	EasyInstall Overhead Spring
5	010476-45	#27 Washer
6	000821-40	Spring Body
7	B-0109-01	6" Wall Bracket
8	004R	Finger Hook
9	000369-40	3/8" NPT x 18" Riser
10	EZ-K	EasyInstall Kit
11	001065-45	O-Ring
12	014200-45	Star Washer, Anti-Rotation
13	018506-19NS	Blue Button Index, Press-in
14	000925-45	Lab Handle Screw
15	012447-25NS	Quarter-Turn Cerama Cartridge w/ Check Valve, Handle, Blue Index & Screw, LTC
16	012395-25NS	Quarter-Turn Cerama Cartridge w/ Check Valve, LTC
17	00AA	1/2" NPT Female Eccentric Flange
18	001019-45	Coupling Nut Washer
19	012394-25NS	Quarter-Turn Cerama Cartridge w/ Check Valve, RTC
20	012446-25NS	Quarter-Turn Cerama Cartridge w/ Check Valve, Handle, Red Index & Screw, RTC
21	001638-45NS	Lever Handle (New Style)
22	001193-19NS	Red Button Index, Press-in

**Product Specifications:**  
Pre-Rinse Unit: EasyInstall 8" Wall Mount Mixing Faucet, Quarter-Turn Cerama Cartridges w/ Check Valves, Lever Handles, 44" Flexible Stainless Steel Hose, 1.07 GPM Spray Valve, 6" Wall Bracket & 1/2" NPT Female Inlets

**Product Compliance:**  
ASME A112.18.1 / CSA B125.1  
NSF 61 - Section 9  
NSF 372 (Low Lead Content)  
2019 DOE PRSV - Class II



# T&S BRASS AND BRONZE WORKS, INC.

2 Saddleback Cove / P.O. Box 1088  
Travelers Rest, SC 29690

Model No.

**B-0230-K**

Item No.

Travelers Rest, SC: 800-476-4103 • Simi Valley, CA: 800-423-0150 • Fax: 864-834-3518 • www.tsbrass.com

This Space for Architect/Engineer Approval

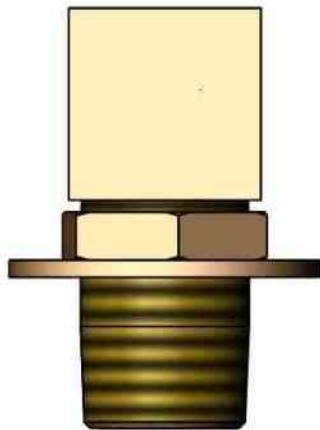
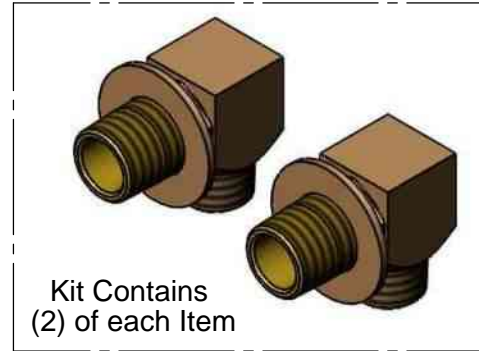
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Model Specified \_\_\_\_\_ Quantity \_\_\_\_\_

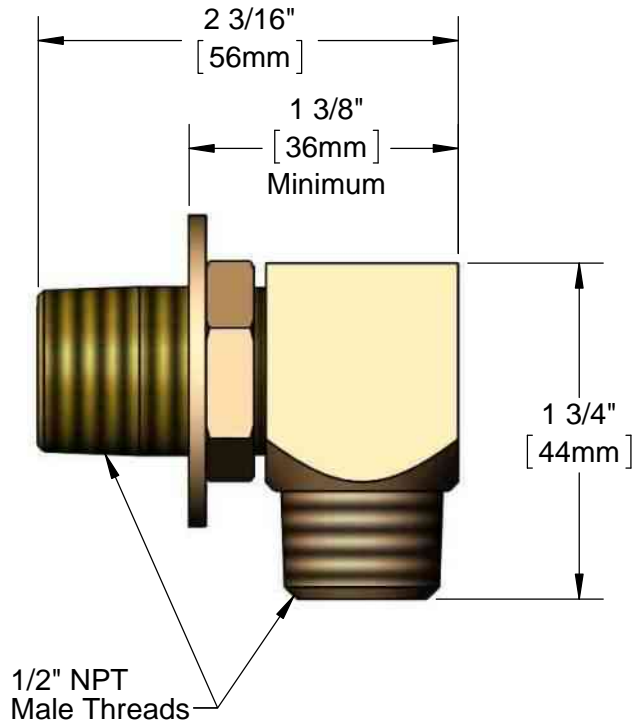
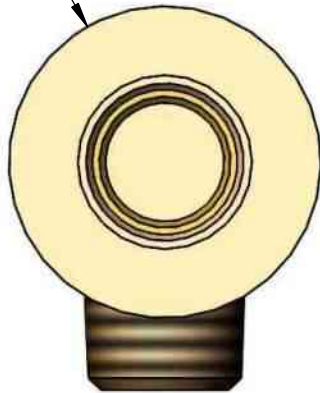
Customer/Wholesaler \_\_\_\_\_

Contractor \_\_\_\_\_

Architect/Engineer \_\_\_\_\_



Ø 1 5/8"  
[41mm]



Product Specifications:  
**1/2" NPT Male Elbow Kit w/ Lock Nut & Washer**

Product Compliance:  
ASME A112.18.1 / CSA B125.1  
NSF 61 - Section 9  
NSF 372 (Low Lead Content)





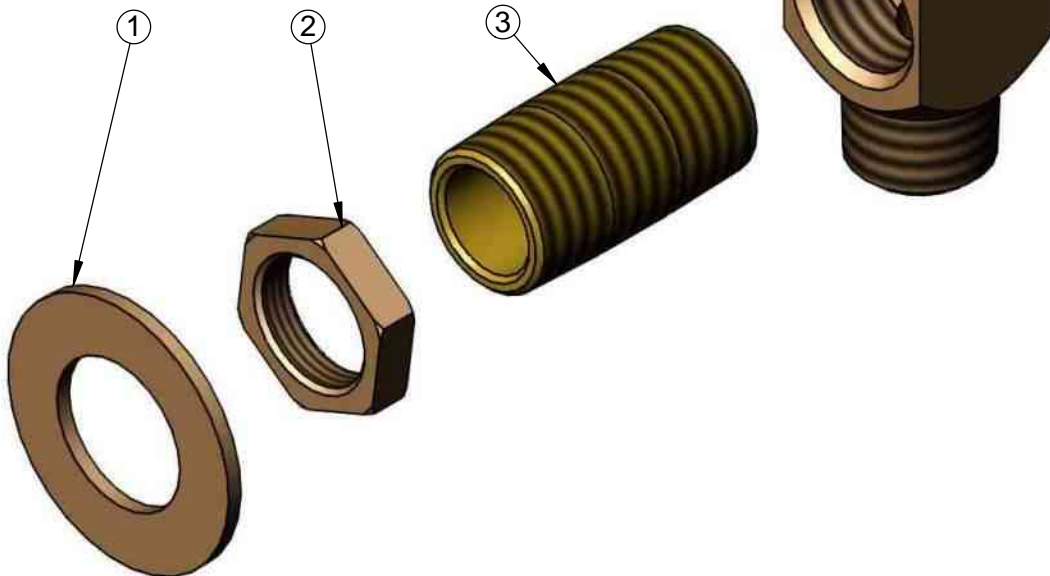
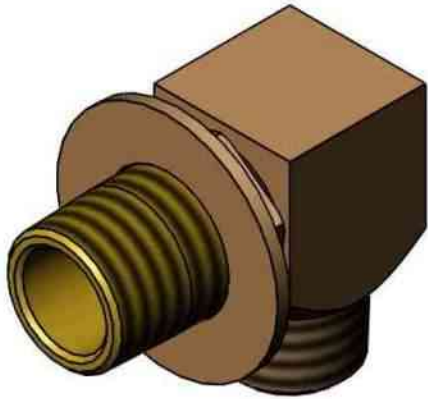
**T&S BRASS AND BRONZE WORKS, INC.**  
 2 Saddleback Cove / P.O. Box 1088  
 Travelers Rest, SC 29690

Model No.  
**B-0230-K**

Item No.

Travelers Rest, SC: 800-476-4103 • Simi Valley, CA: 800-423-0150 • Fax: 864-834-3518 • www.tsbrass.com

ITEM NO.	SALES NO.	DESCRIPTION
1	000999-45	Brass Lock Washer
2	002954-45	Shank Lock Nut
3	013357-20	1/2" NPT x 1-5/8" Lg. Close Nipple



Product Specifications:  
 1/2" NPT Male Elbow Kit w/ Lock Nut & Washer

Product Compliance:  
 ASME A112.18.1 / CSA B125.1  
 NSF 61 - Section 9  
 NSF 372 (Low Lead Content)





## Submittal Sheet

01/09/2023

### ITEM# 12 - DISPOSER (1 EA REQ'D)

InSinkErator SS-300-18B-AS101

SS-300™ Complete Disposer Package, with 18" diameter bowl, 6-5/8" diameter inlet, with sleeve guard & splash baffle, 3 HP motor, stainless steel construction, includes syphon breaker, (2) solenoid valves, (2) flow control valves, programmable AquaSaver® Control Center AS-101 with water-saving technology, automatic water saving function, auto reversing, timed run, post flush

#### ACCESSORIES

Mfr	Qty	Model	Spec
InSinkErator	1		(3) years parts & labor warranty from date of installation (standard)
InSinkErator	1		Standard height disposer body
InSinkErator	1		Specify voltage
InSinkErator	1	SYPHON STD	Syphon breaker standard, 1/2" (11477)
InSinkErator	1	FT FLANGE	Flange foot for floor mounting (per leg) (14394)

#### ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1									3		

#### WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1				1/2"					

#### WASTE

	INDIRECT SIZE	DIRECT SIZE
1		3"

PROJECT: \_\_\_\_\_ ITEM NO.: \_\_\_\_\_



# SS SERIES FOOD WASTE DISPOSERS

Food waste disposers are a hygienic and environmentally sustainable way to manage pre- and post-consumer scraps in a foodservice establishment. The SS Series disposers are ideal for heavy-duty applications such as restaurants, schools and universities, healthcare facilities and hospitals, and government facilities.

## PRODUCT FEATURES & SPECIFICATIONS

**1**  
YEAR  
ON-SITE  
PARTS & LABOR  
WARRANTY

### SS-SERIES

- Whether you serve 25 or 2,500 people, there is an InSinkErator disposer that's designed for your operation. From the small-capacity SS-100™ model to our large-capacity SS-1000™ workhorse, InSinkErator disposers deliver superior performance, quiet operation, maximum energy efficiency, and reliable service.

### SYSTEM OVERVIEW

- Stainless steel and chrome-plated finish
- Corrosion-resistant, stainless steel grind chamber
- Heavy-duty induction motor with built-in thermal overload protection
- Enclosure provides protection against outside moisture with controlled power air flow to cool motor
- Cast-nickel, chrome-alloy stationary and rotating shredding elements
- Double-tapered Timken roller bearings provide a shock-absorbing cushion
- Triple lip seal protects motor from water damage
- Secondary spring-loaded oil seal provides double protection against water and loss of grease

### CLEANING

- Disposers are easy to clean and maintain
- Wipe down exterior surfaces with a wet cloth
- Use warm soapy water on the splashguard



### Commercial Disposer Sizing Chart

To determine the proper size disposer, use this recommended sizing chart. Sizing recommendations are given in general terms; actual capacities vary depending on the volume and type of food waste.

Volume Processed / Application	High Buffet/Cafeteria Government	SS-300	SS-300/ SS-500	SS-500	SS-500/ SS-1000	SS-500/ SS-1000
	Medium Full Service Restaurant	SS-200	SS-300	SS-300/ SS-500	SS-500	SS-500/ SS-1000
	Low Limited Service Restaurant/Café/ Fast Casual	SS-100	SS-200	SS-300	SS-300/ SS-500	SS-1000
		SS-100	SS-100	SS-200	SS-300	SS-300/ SS-500
		<b>Light</b> Majority Fruits & Vegetables	<b>Medium</b> 50/50 Mixture	<b>Heavy</b> Majority Meats & Seafood		
<b>Food Waste Composition</b>						

A complete collection of our product drawings is available for download at the **InSinkErator Revit/CAD Library**, which can be found at [www.insinkerator.com/foodservice](http://www.insinkerator.com/foodservice). Product information is also accessible on **The KCL CADalog**. More information is available from KCL at [www.kclcad.com](http://www.kclcad.com).



4700 21st STREET  
RACINE, WI 53406  
TEL: 800-845-8345  
FAX: 262 554-3620  
[www.insinkerator.com/foodservice](http://www.insinkerator.com/foodservice)



The Emerson logo is a trademark and a service mark of Emerson Electric Co.




## WHAT'S INCLUDED


- Base disposer: 1 mounting gasket
- Disposer packages: 1 mounting/bowl assembly, 1 electrical control, 1 syphon breaker, 1 solenoid valve, and 1 flow control valve (the standard flow control valve will be sent with the unit unless the optional valve is specified)

## MODEL & HORSEPOWER/ELECTRICAL REQUIREMENTS (CHOOSE ONE)


### Small Capacity Disposers

	<input type="checkbox"/> <b>SS-100</b> 1 HP	<input type="checkbox"/> 115/208-230V, 60 Hz, 1 Ph, 11.6/5.1/5.7 amps, <b>cULus</b>	<input type="checkbox"/> 120/208-240V, 60 Hz, 1 Ph, 11.6/5.1/5.7 amps, <b>NOM</b>
	<b>Water Usage:</b>	<input type="checkbox"/> 208-230/460V, 60 Hz, 3 Ph, 2.0/2.4/1.2 amps, <b>cULus</b>	<input type="checkbox"/> 100/200-230V, 50/60 Hz, 1 Ph, 10.4/5.2/5.4 amps
		<input type="checkbox"/> 5 GPM (18.9 LPM) standard water flow	<input type="checkbox"/> 3 GPM (11.4 LPM) reduced water flow (optional)

### Medium Capacity Disposer

	<input type="checkbox"/> <b>SS-200</b> 2 HP	<input type="checkbox"/> 115/208-230V, 60 Hz, 1 Ph, 17.4/7.7/8.7 amps, <b>cULus</b>	<input type="checkbox"/> 208-230/460V, 60 Hz, 3 Ph, 3.6/4.4/2.2 amps, <b>cULus, short body</b>
	<b>Water Usage:</b>	<input type="checkbox"/> 208-230/460V, 60 Hz, 3 Ph, 3.6/4.4/2.2 amps, <b>cULus, short body</b>	<input type="checkbox"/> 208-240/460V, 60 Hz, 3 Ph, 3 Ph, 3.6/4.4/2.2 amps, <b>NOM</b>
		<input type="checkbox"/> 115/208-230V, 60 Hz, 1 Ph, 17.4/7.7/8.7 amps, <b>cULus, short body</b>	<input type="checkbox"/> 7 GPM (26.5 LPM) standard water flow
			<input type="checkbox"/> 5 GPM (18.9 LPM) reduced water flow (optional)

### Large Capacity Disposers

	<input type="checkbox"/> <b>SS-300</b> 3 HP	<input type="checkbox"/> 208-230/460V, 60 Hz, 3 Ph, 6.0/7.4/3.7 amps, <b>CUL</b>	<input type="checkbox"/> 415V, 50 Hz, 3 Ph, 4.9 amps
	<b>Water Usage:</b>	<input type="checkbox"/> 208-230/460V, 60 Hz, 3 Ph, 6.0/7.4/3.7 amps, <b>CUL, short body</b>	<input type="checkbox"/> 220V, 50 Hz, 3 Ph, 7.2 amps
		<input type="checkbox"/> 208-230/460V, 60 Hz, 3 Ph, 7.0/8.6/3.7 amps, <b>NOM</b>	<input type="checkbox"/> 380V, 50/60 Hz, 3 Ph, 4.1/3.0 amps
		<input type="checkbox"/> 8 GPM (30.3 LPM) standard water flow	<input type="checkbox"/> 7 GPM (26.5 LPM) reduced water flow (optional)
	<input type="checkbox"/> <b>SS-500</b> 5 HP	<input type="checkbox"/> 208-230/460V, 60 Hz, 3 Ph, 8.6/8.8/4.4 amps, <b>CUL</b>	<input type="checkbox"/> 415V, 50 Hz, 3 Ph, 6.0 amps
	<b>Water Usage:</b>	<input type="checkbox"/> 208-230/460V, 60 Hz, 3 Ph, 8.6/8.8/4.4 amps, <b>CUL, short body</b>	<input type="checkbox"/> 380V, 50 Hz, 3 Ph, 8.9 amps
		<input type="checkbox"/> 230/460V, 50 Hz, 3 Ph, 9.0/4.5 amps	
		<input type="checkbox"/> 8 GPM (30.3 LPM) standard water flow	<input type="checkbox"/> 7 GPM (26.5 LPM) reduced water flow (optional)
	<input type="checkbox"/> <b>SS-1000</b> 10 HP	<input type="checkbox"/> 208-230/460V, 60 Hz, 3 Ph, 11.0/13.0/6.5 amps, <b>CUL</b>	
	<b>Water Usage:</b>	<input type="checkbox"/> 208-230/460V, 60 Hz, 3 Ph, 11.0/13.0/6.5 amps, <b>CUL, short body</b>	
		<input type="checkbox"/> 10 GPM (37.9 LPM) standard water flow	

## DISPOSER MOUNTING ASSEMBLIES (CHOOSE ONE)

### Sink Collar Mounts



- #5 Sink Flange Kit**  
for 3-1/2"–4" (88.9 mm–101.6 mm) sink opening (support legs are recommended)  
*#5 adaptors only available on small and medium capacity disposers.*



- #6 Collar Adaptor Kit**  
for welding into trough, for 6-5/8" (168.3 mm) opening, includes splash baffle



- #7 Collar Adaptor Kit**  
for welding into sink, for 6-5/8" (168.3 mm) opening, includes splash baffle and stopper

### Sink Bowl Mounts

#### Bowl Size

- 12" (304.8 mm) with one adjustable water nozzle
- 15" (381.0 mm) with one adjustable water nozzle
- 18" (457.2 mm) with two adjustable water nozzles

#### Kit Type



- Type A Sink Bowl Assembly**
- bowl
  - water nozzle(s)
  - bowl cover
  - splash baffle








- Type B Sink Bowl Assembly**
- bowl
  - water nozzle(s)
  - silver guard
  - splash baffle



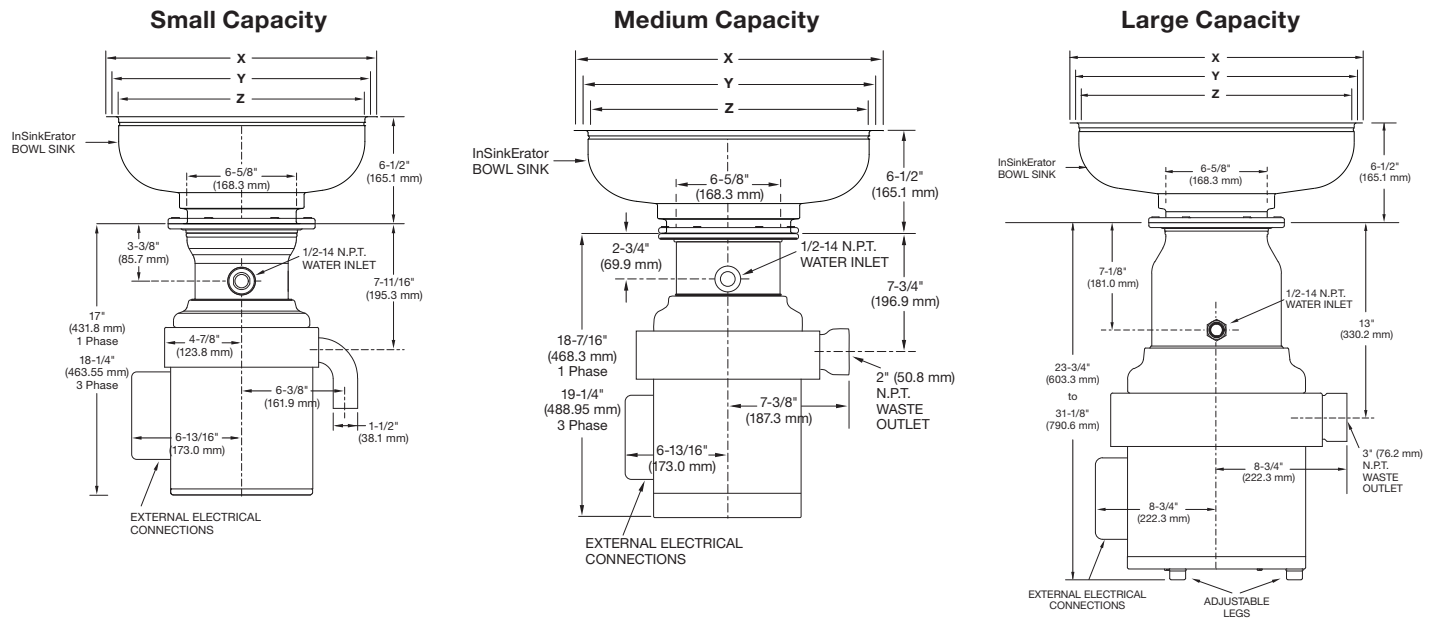
- Type C Sink Bowl Assembly**
- bowl
  - water nozzle(s)
  - splash baffle

## ELECTRICAL CONTROLS (CHOOSE ONE)

<input type="checkbox"/> AS-101 Control Center AquaSaver®	<input type="checkbox"/> CC-101 Control Center	<input type="checkbox"/> CC-202 Control Center	<input type="checkbox"/> Manual Reverse Switch	<input type="checkbox"/> Manual Switch
 <ul style="list-style-type: none"> <li>Automatically changes direction</li> <li>Stainless-steel housing</li> <li>Automatic shut-off with power loss</li> <li>Line disconnect</li> <li>Programmable post-flush</li> <li>Timed run</li> <li>Automatically regulates water flow to grind load</li> </ul>	 <ul style="list-style-type: none"> <li>Automatically changes direction</li> <li>Stainless-steel housing</li> <li>Automatic shut-off with power loss</li> <li>Line disconnect</li> <li>Programmable post-flush</li> <li>Timed run</li> </ul>	 <ul style="list-style-type: none"> <li>Automatically changes direction</li> <li>Stainless-steel housing</li> <li>Automatic shut-off with power loss</li> </ul>	 <ul style="list-style-type: none"> <li>Manually changes direction</li> <li>Stainless-steel housing</li> <li>Automatic shut-off with power loss</li> </ul>	 <ul style="list-style-type: none"> <li>Single direction</li> <li>Polycarbonate housing</li> <li>Automatic shut-off with power loss</li> </ul>

## DISPOSER DIMENSIONS

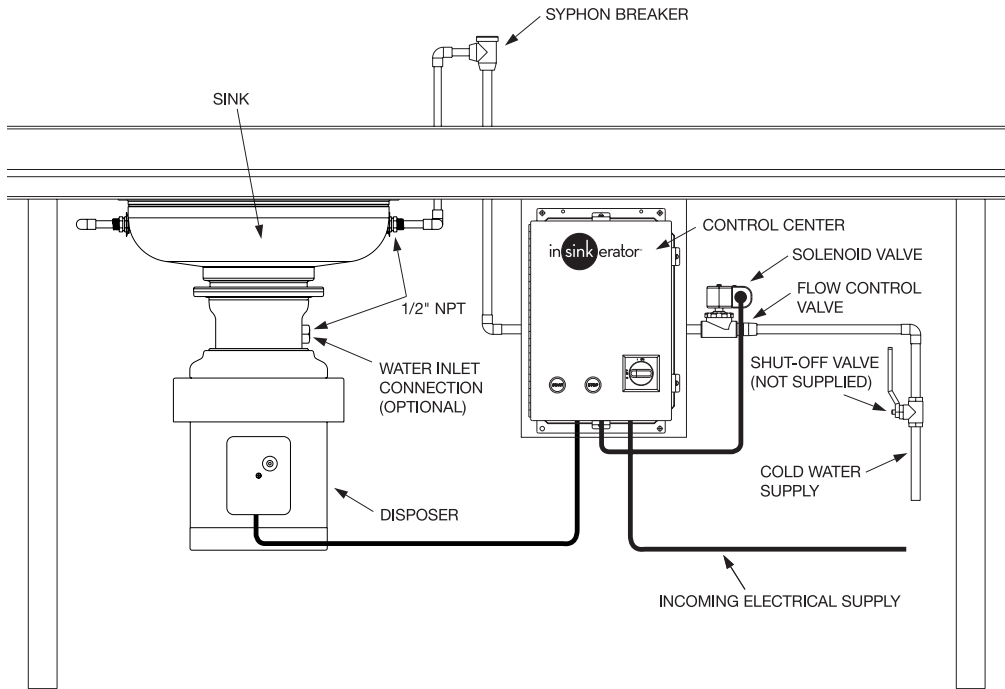
Standard models shown. A short body model is available on medium and large capacity disposers. Short body models reduce overall height by 1" (25.4 mm) on medium capacity disposers and by 3" (76.2 mm) on large capacity disposers.



If mounting directly to a sink, use dimension chart below for adaptor height in place of InSinkErator bowl sink height. **IMPORTANT: #5 adaptors only available on small and medium capacity disposers.**

Bowl Mounts	Flange O.D. X	Work Table Hole Y	Flange I.D. Z	Height
12" (304.8 mm)	13-1/2" (342.9 mm)	12-1/4" (311.2 mm)	12" (304.8 mm)	6-1/2" (165.1 mm)
15" (381 mm)	16-1/2" (419.1 mm)	15-1/4" (387.4 mm)	15" (381.0 mm)	6-1/2" (165.1 mm)
18" (457.2 mm)	19-1/2" (495.3 mm)	18-1/4" (463.6 mm)	18" (457.2 mm)	6-1/2" (165.1 mm)
Collar Mounts	X	Y	Z	Height
#5	Fits Standard Sink Opening: 3-1/2" – 4" (88.9 mm – 101.6 mm)			2-3/4" (69.9 mm)
#6	7-13/16" (198.4 mm)	6-7/8" (174.6 mm)	6-5/8" (168.3 mm)	1-3/16" (30.2 mm)
#7	9-1/8" (231.8 mm)	7-7/8" (200.0 mm)	7-5/8" (193.7 mm)	2-1/16" (52.4 mm)

## TYPICAL INSTALLATION - BOWL



## REPLACING A COMPETITIVE DISPOSER

- Refer to the Mounting Adaptor Guide or Video for adaptors that fit competitor sink bowls or cones.
- Have sink bowl/cone type with appropriate dimensions available when contacting Customer Service with questions or to place an order.

## SAMPLE SPECIFICATION

InSinkErator Food Waste Disposer. Food waste grinding system with \_\_\_\_\_ HP disposer, \_\_\_\_\_ control panel. \_\_\_\_\_ Volts, \_\_\_\_\_ Hz, \_\_\_\_\_ Phase operation. \_\_\_\_\_ disposer mount. Syphon breaker with 1/2" NPT connections; flow control valve; (1) 24V water solenoid.

## PROJECT INFORMATION

Item Number: \_\_\_\_\_

Model Number: \_\_\_\_\_

Quantity: \_\_\_\_\_

Electrical

Requirements:

Manufacturer: InSinkErator \_\_\_\_\_

\_\_\_\_\_ volts \_\_\_\_\_ phase

Project: \_\_\_\_\_

Dealer: \_\_\_\_\_

Address: \_\_\_\_\_

City/State/Zip: \_\_\_\_\_

City/State/Zip: \_\_\_\_\_

Contact: \_\_\_\_\_

Contact: \_\_\_\_\_

Phone: \_\_\_\_\_

Phone: \_\_\_\_\_

Installer: \_\_\_\_\_

Consultant: \_\_\_\_\_

Contact: \_\_\_\_\_

Contact: \_\_\_\_\_

Phone: \_\_\_\_\_

Phone: \_\_\_\_\_

PROJECT: \_\_\_\_\_ ITEM NO.: \_\_\_\_\_



# ACCESSORIES



## ADJUSTABLE SUPPORT LEGS

- Sold in sets of two legs
- Two support legs can be added to small or medium size disposers for added stability
- Three support legs are included with all large disposers
- Recommended when using the following disposer mounting adapters: 11378A, 11378B, 11378C, 11599H, 11599K, 11599N
- P/N 11757C



## FLANGE FOOT

- Provides secure floor mounting option for commercial disposers
- Use anywhere extra stability or security is a concern
- Flange foot is sold individually and includes one set screw
- Order two feet for medium size units and three feet for large units
- P/N 14394



## THROAT GUARD

- Throat Guard mounts at the throat opening of the disposer
- Keeps hands safely away from disposer grind chamber
- Cannot be removed while disposer is installed on sink or trough
- Fits any disposer with a standard 6<sup>5</sup>/<sub>8</sub>" throat opening
- Includes gasket and mounting bolts
- P/N 13620



## TAMPER-PROOF CONTROL PANEL SCREWS

- Replaces standard closure screws on disposer control panels
- Eliminates unauthorized entry into control panel for safety and security
- For use with CC-101, CC-202, AS-101, WX-101 and PR-101 disposer control panels
- Includes four control panel replacement screws and matching wrench
- P/N 13946



## MAGNETIC SILVER SAVER

- Mounts to any trough system
- To order, specify part# 13983
- One Trough Magnetic Silver Saver approximately 18 inches from disposer hole is recommended. Additional magnets along length of trough are optional.

Our products appear on **The KCL CADalog** CD-ROM based CAD Foodservice Symbol Library. More information is available from **Kochman Consultants, Ltd.** at [www.kclcad.com](http://www.kclcad.com).



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RACINE, WI 53406  
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[www.insinkerator.com](http://www.insinkerator.com)



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## Submittal Sheet

01/09/2023

### ITEM# 13 - DISHWASHER, CONVEYOR TYPE (1 EA REQ'D)

Hobart CL64EN-ADV+BUILDUP

Conveyor Dishwasher, Advansys model, (2) tank, (342) racks/hour, insulated hinged doors, .39 gallon/rack, stainless steel enclosure panels, microprocessor controls with low temperature & dirty water indicators, NSF Pot & Pan mode, programable de-lime notification, 30 kW stainless booster, energy recovery (DWER), automatic soil removal (ASR), drain water tempering kit, ENERGY STAR®, Free factory startup for installations within a 100 mile radius of a Hobart service office; installation beyond 100 miles will be charged at the quoted rate by the local Hobart service office

#### ACCESSORIES

Mfr	Qty	Model	Spec
Hobart	1		Oversized units with crated shipping dimensions greater or equal to 72" in length and/or 90" in height. If delivery is to a facility without a standard height dock, additional shipping charges will apply depending on the service requested. consult Factory.
Hobart	1		Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA
Hobart	1	CL64EN-ADVHTE15K	Electric tank heat 15kW wash/10kW rinse
Hobart	1	CL64EN-ADVERH30K	30kW electric booster
Hobart	1	CL64EN-ADVELEOCD	480v/60/3-ph
Hobart	1		Single Point (1) service connection standard (Field convertible options available)
Hobart	1	CL64EN-ADVHGTSTD	Standard height
Hobart	1	CL64EN-ADVDIR0RL	Right to left operation
Hobart	1	BDERLCD-STDDOM	Blower Dryer, Electric, R - L, 480v/60/3-ph, Standard Height, Domestic
Hobart	1		NOTE: When blower dryer is selected, only (1) E Series vent hood (below) needed for load/soiled side vent connection; Blower Dryer assembly includes vent stack for unload/clean side vent connection. CLeN Blower Dryer MUST BE DIRECT VENTED, CANNOT BE INSTALLED UNDER CANOPY HOOD
Hobart	1		Installation by local Hobart Service Office if within 100 mile radius & done during normal business hours. 72 Hour Assembly Notice Recommended. Must be ordered with Hobart Dishmachine. Price includes assembly of blower dryer to Hobart dishmachine ONLY. Installation of dishmachine can be by others. Does not include drain connection.
Hobart	1	CL64EN-ADVFEETSTD	Standard feet
Hobart	2	WS80-NOINSTALL	Water softening system 4,818 grains/lb capacity, 14 gallons regeneration volume, salt alarm, holds 2 bags of salt, pricing DOES NOT include installation. INSTALLATION BY AUTHORIZED HOBART SERVICE OFFICE IS RECOMMENDED (NET)



Hobart	2	VNTHD/E-ADJ	E-series vent hood domestic (adjustable)
Hobart	1	SHTPAN-RACK	Rack, 6 sheet pan
Hobart	1	1/2INSHK-ABSRBR	Water Shock Absorber Kit (2 required - 1 each incoming hot and cold water lines)
Hobart	1	CLE/TBL-SWITCH	Table limit switch CLE-Series

### ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCF
1								10.0			
2								15			
3								30			
4	480	60	3								
5	480	60	3								

#### ELECTRICAL 1 REMARKS

Tank Heat: Rinse kW

#### ELECTRICAL 2 REMARKS

Tank Heat: Wash kW

#### ELECTRICAL 3 REMARKS

booster requires separate electrical connection

### WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1	1/2"			1/2"					
2									

### WASTE

	INDIRECT SIZE	DIRECT SIZE
1	2"	
2	1"	

#### PLUMBING 1 REMARKS

cold water connection for optional drain water tempering kit





Project \_\_\_\_\_

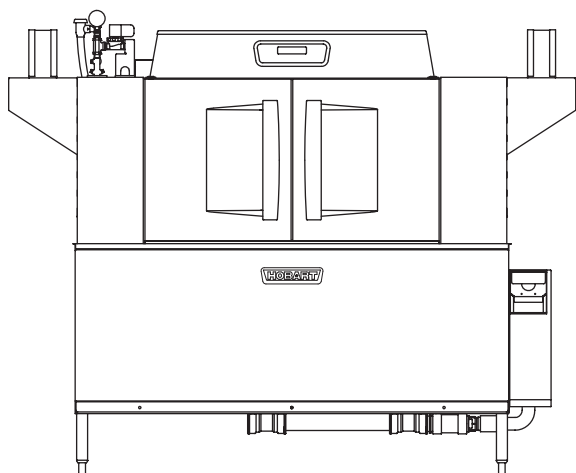
AIA # \_\_\_\_\_ SIS # \_\_\_\_\_

Item # \_\_\_\_\_ Quantity \_\_\_\_\_ C.S.I. Section 114000



## CL64eN-ADV advansys ELECTRIC

### High Temperature Rack Conveyor Dishwashing Machine



### SPECIFIER STATEMENT

Specified dishwasher will be Hobart CL64eN Advansys electric tank heat model with drain water energy recovery (DWER), automatic soil removal (ASR) and Opti-Rinse™. Includes 342 racks per hour capacity, dirty water indicator, configurable “intelligent” de-lime notification, top mounted computer controls, and NSF approved pot and pan cycle mode. The wash tank utilizes durable precision pressure sensor monitors in lieu of conventional mechanical floats. The 19.5" standard chamber height will accommodate up to (6) standard sheet pans at a time on an open-end sheet pan rack.

### STANDARD FEATURES

- + 342 racks per hour
- + Drain water energy recovery (DWER)
- + Automatic soil removal (ASR)
- + Opti-Rinse™ system
- + Rapid return conveyor drive mechanism
- + Internal stainless steel pressure-less 30 KW booster heater
  - Dual point electrical connection standard on 208/60/3 and 240/60/3 voltage machines; single point kits available (see page 3)
  - Single point connection standard on 480/60/3 and 600/60/3 voltage machines
- + Large double door opening for ease of cleaning
- + Doors are insulated & hinged with door interlock switches
- + 19.5" chamber height opening (accepts sheet pans)
- + Top mounted micro-processor control module
- + Energy saver mode (programmable auto-shut down)
- + Dirty water indicator
- + Manager activated low temperature alert
- + NSF rated configurable pot and pan dwell mode
- + Configurable “intelligent” delime notification
- + Service diagnostics
- + Self-aligning wash manifolds
- + Stainless steel anti-clogging wash arms
- + Removable pump intake screen
- + Stainless steel self-draining pump and impeller
- + Single, sloping scrap screen and deep scrap basket
- + Stainless panels enclose perimeter and bottom
- + Door actuated drain closure
- + Convertible hot water or low temp final rinse
- + Vent fan control
- + Booster heater control
- + ENERGY STAR® Certified

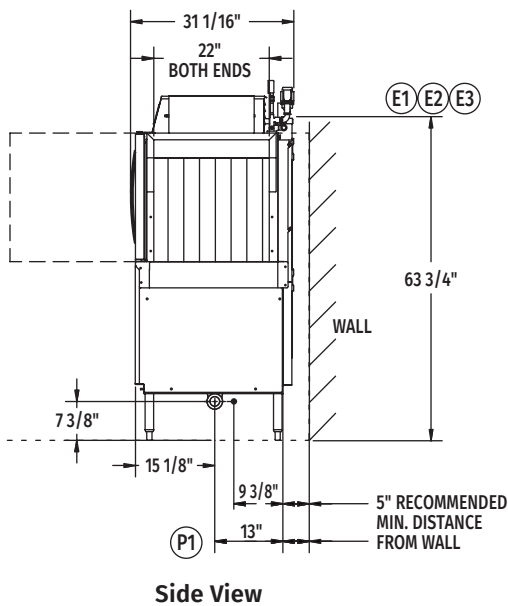
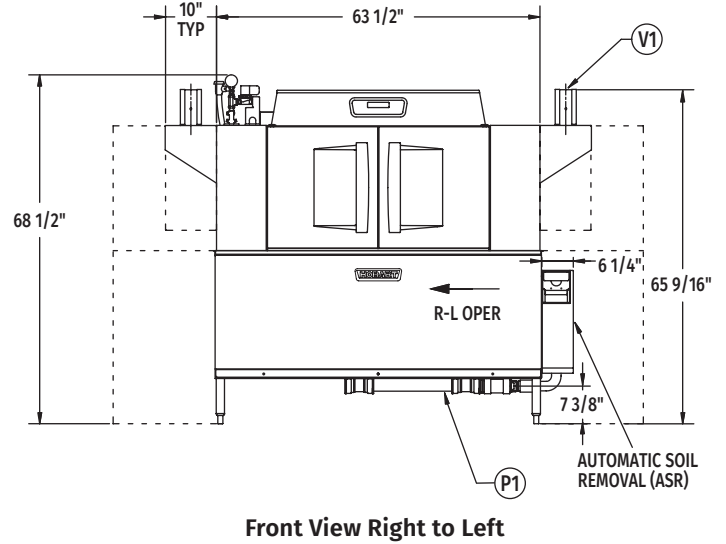
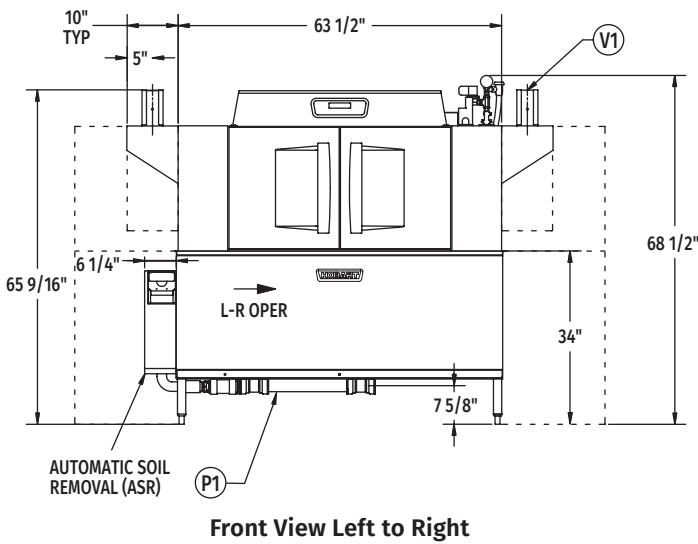
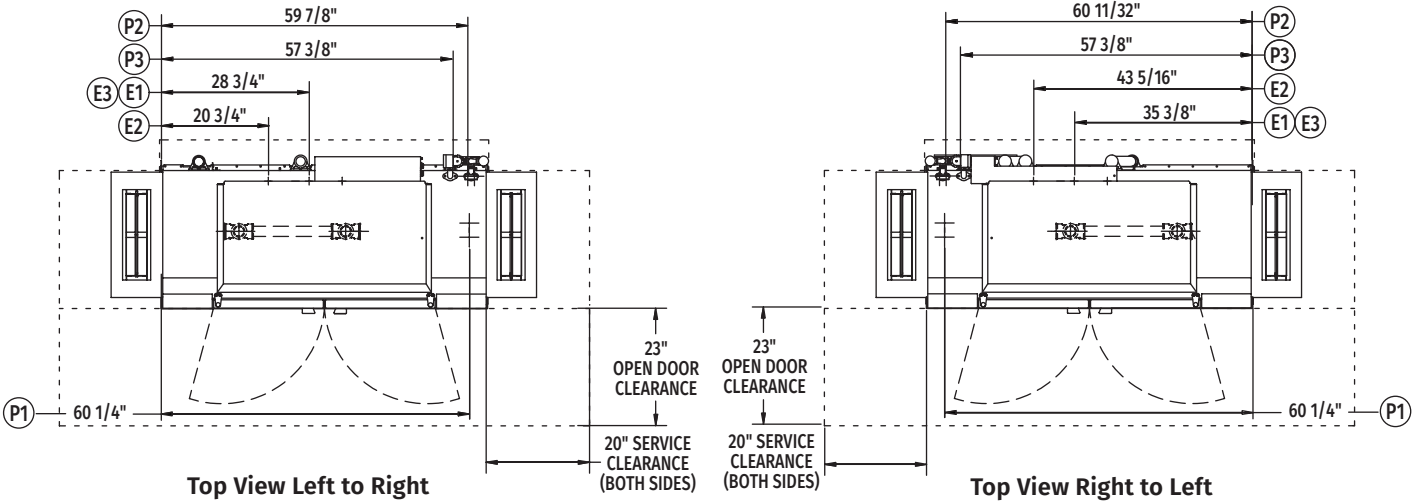
### OPTIONS & ACCESSORIES (Available at extra cost)

- Standard, short, and extended stainless steel vent hoods
- Direct drive unloader – adds 38" length. Reference spec F39520 for more details
- Side loader – SL23 adds 23" length, SL30 adds 30" length. Reference specs F40926 and F40927 for more details
- Blower-dryer – adds 33¾" to length. Reference spec F40252 for more details (ships separate from dishmachine, contact Hobart Service for installation)
- Flanged feet kit (requires two kits)
- Higher than standard chamber (24" opening)
- Table limit switch with 10' wire
- Correctional package (contact Hobart for details)
- Pressure regulator valve (PRV), for use with external booster
- Water shock absorber kit
- Factory-mounted circuit breakers (contact Hobart for details)
- Field installed single point kits available for 208/60/3 and 240/60/3 machines when equipped with internal booster

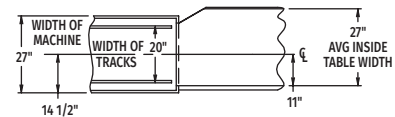
Approved by \_\_\_\_\_ Date \_\_\_\_\_ Approved by \_\_\_\_\_ Date \_\_\_\_\_



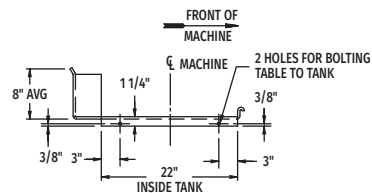
# CL64eN-ADV advansys ELECTRIC High Temperature Rack Conveyor Dishwashing Machine



### Tabling Connection: 64" inside tank (at table connection)



### Suggested Track and Table Layout



MODEL: CL64eN ADVANSYS  
L-R OPERATION  
D-974805  
REV B

MODEL: CL64eN ADVANSYS  
R-L OPERATION  
D-974804  
REV B



# CL64eN-ADV *advansys* ELECTRIC

## High Temperature Rack Conveyor Dishwashing Machine

### LEGEND

Electrical Connections	
Required when machine equipped with <b>SINGLE POINT ELECTRICAL CONNECTION</b>	
E1	Tank heat, motors, controls AND 30kW booster heater – multiple knockouts provided, 63-3/4" AFF.
Required when machine equipped with <b>DUAL POINT ELECTRICAL CONNECTION</b>	
E2	Tank heat, motors and controls – multiple knockouts provided, 63-3/4" AFF.
E3	Internal 30kW booster heater – multiple knockouts provided, 63-3/4" AFF.
Multiple knockouts provided for 2", 1" and 1/2" trade size conduits.	
Plumbing Connections	
P1	Drain. May be drained to either side of valve, plug opposite side 2" FPT. Recommend a floor drain minimum of 12" from machine for access and maintenance. 7-3/8" AFF.
P2	Hot water. 1/2" FPT connection. 1/2", 11-3/16" AFF. See plumbing notes for required temperatures.
P3	Cold water connection 1/2" FPT, cold water temperature 80°F, maximum 7-3/8" AFF.
Vent Connections	
V1	Optional vent hoods, 4" x 16" vent stack with damper.

### SPECIFICATIONS

<b>Capacities</b>	
Racks Per Hour (NSF rated) . . . . .	342
Wash Tank (U.S. gallons) . . . . .	23
Rinse Tank (U.S. gallons) . . . . .	22
Conveyor Speed (feet per minute) . . . . .	9.5
<b>Motor Horsepower</b>	
Drive . . . . .	1/6
Wash . . . . .	2
Rinse . . . . .	2
ASR . . . . .	1/2
<b>Water Consumption</b>	
U.S. Gallons per Hour (maximum use at 20 PSI) . . . . .	132
U.S. Gallons per Rack . . . . .	0.39
Peak Drain Flow (U.S. gallons per minute) . . . . .	38
<b>Heating</b>	
Tank Heat, Electric (kW) . . . . .	25
Electric Booster (built-in) (kW for 70°F rise) . . . . .	30
<b>Venting</b>	
Load End (minimum CFM) . . . . .	200
Unload End (minimum CFM) . . . . .	400
<b>Shipping Weight (approximate)</b> . . . . .	920 lbs.
<b>Crated Dimensions</b> . . . . .	74"L x 38"W x 78"H

E1	Single Point Electrical Connection with internal 30 kW Booster Heater		
Voltage	(E1) Tank Heat, Motors, Controls 30kW Booster Heater		Single Point Service Connection
	Rated Amps	Minimum Supply Circuit Ampacity / Maximum Protective Device	
208/60/3	175.0	200	Field Installed <b>SGLPT-KIT3-CLE</b> required, order separately
240/60/3	167.0	200	Field Installed <b>SGLPT-KIT3-CLE</b> required, order separately
480/60/3	85.0	100	Ships Standard, Factory Installed
600/60/3	59.1	80	Ships Standard, Factory Installed

E2	Dual Point Electrical Connection with Internal 30 kW Booster Heater				
Voltage	(E2) Tank Heat, Motors, Controls		(E3) 30kW Booster Heater		Dual Point Service Connection
	Rated Amps	Minimum Supply Circuit Ampacity / Maximum Protective Device	Rated Amps	Minimum Supply Circuit Ampacity / Maximum Protective Device	
208/60/3	90.6	125	83.9	90	Dual Point Ships Standard
240/60/3	86.6	125	80.2	90	Dual Point Ships Standard
480/60/3	44.9	60	40.1	50	Field Convertible
600/60/3	32.2	45	26.9	40	Field Convertible



## CL64eN-ADV advansys ELECTRIC

### High Temperature Rack Conveyor Dishwashing Machine

**WARNING:** Plumbing and electrical connections should be made by qualified personnel who will observe all the applicable plumbing, sanitary, safety codes and National Electrical Code.

**Plumbing Notes:** Minimum incoming water temperatures: 110°F for 30kW internal booster. Building flowing water pressure to dish machine is 20 PSI, (+/- 5 PSI).

Single cold water connection supplies both drain water energy recovery and drain water tempering.

Recommended water hardness to be 3 grains or less for best results.

**Electrical Note:** Dishmachine not provided with internal GFCI protection.

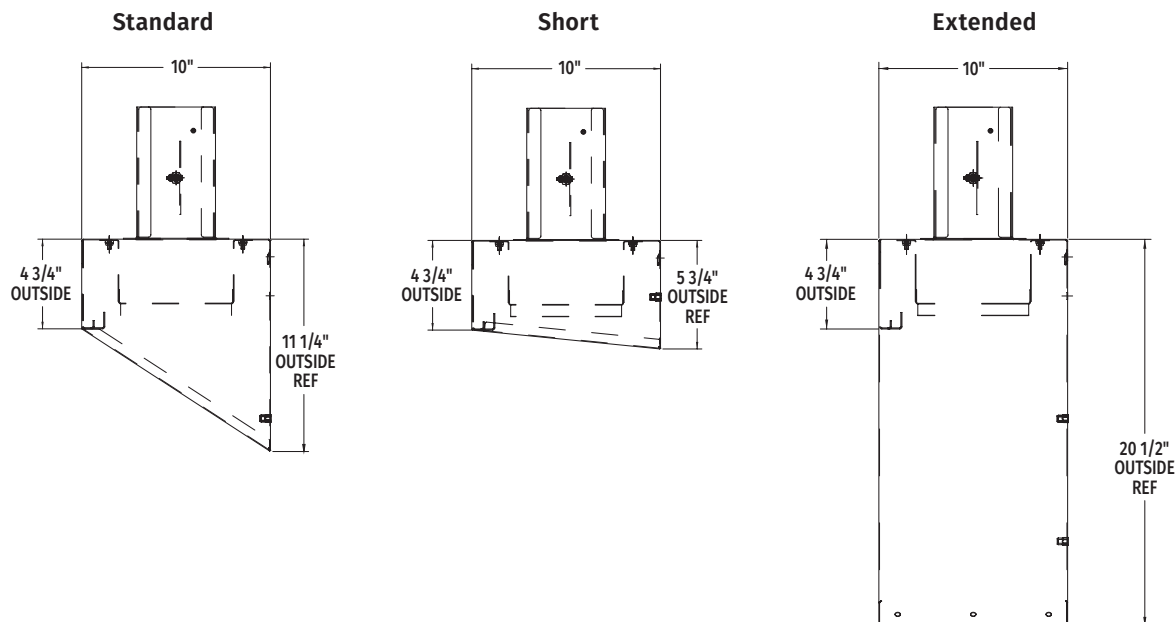
#### CL64eN-ADV Electric Heat Dissipation

BTU/HR.

Latent	Sensible
52,300	22,400

**NOTE:** Additional CLeN Voltages and Amperages are available, see document F40972.

#### VENT HOOD OPTIONS (Adjustable, vent stack can be adjusted 1" to either side)



As continued product improvement is a policy of Hobart, specifications are subject to change without notice.



Project \_\_\_\_\_

AIA # \_\_\_\_\_ SIS # \_\_\_\_\_

Item # \_\_\_\_\_ Quantity \_\_\_\_\_ C.S.I. Section 114000



## ALL ELECTRIC BLOWER-DRYER ACCESSORY

For CLeN Series



For use with  
CLeN Series Dishwashers

### STANDARD FEATURES

- + Stainless steel 33" long chamber
- + Positive forced circulation of high velocity heated air
- + Fits CLeN models
- + High velocity industrial type blower-dryer is quiet, giving truly high performance at a low sound level
- + 2 H.P. blower
- + 10 KW electric heat

### DIRECTION OF OPERATION

- Right to Left
- Left to Right

### VOLTAGE

- 208/60/3
- 240/60/3
- 380/60/3
- 480/60/3
- 600/60/3
- 200/50/3
- 380-415/50/3

### SPECIFIER STATEMENT

Designed to promote rapid drying of tableware and trays by forced circulation of high velocity heated air through the blower dryer. Heavy-duty direct drive industrial fan blows room air through electric heater and large area ducting. Heated air directed vertically downward to drying area through rectangular orifice covering full width of chamber. Baffles below conveyor redirect air upward within drying area and minimize heating of discharge table or hot air contact with clean-dish operator at end of machine. Any object which will pass through the machine will be handled at the dryer area without necessity of readjusting blower plenum upward or downward.

CLEAN SERIES – ALL ELECTRIC BLOWER-DRYER ACCESSORY

Approved by \_\_\_\_\_ Date \_\_\_\_\_ Approved by \_\_\_\_\_ Date \_\_\_\_\_



# ALL ELECTRIC BLOWER-DRYER ACCESSORY

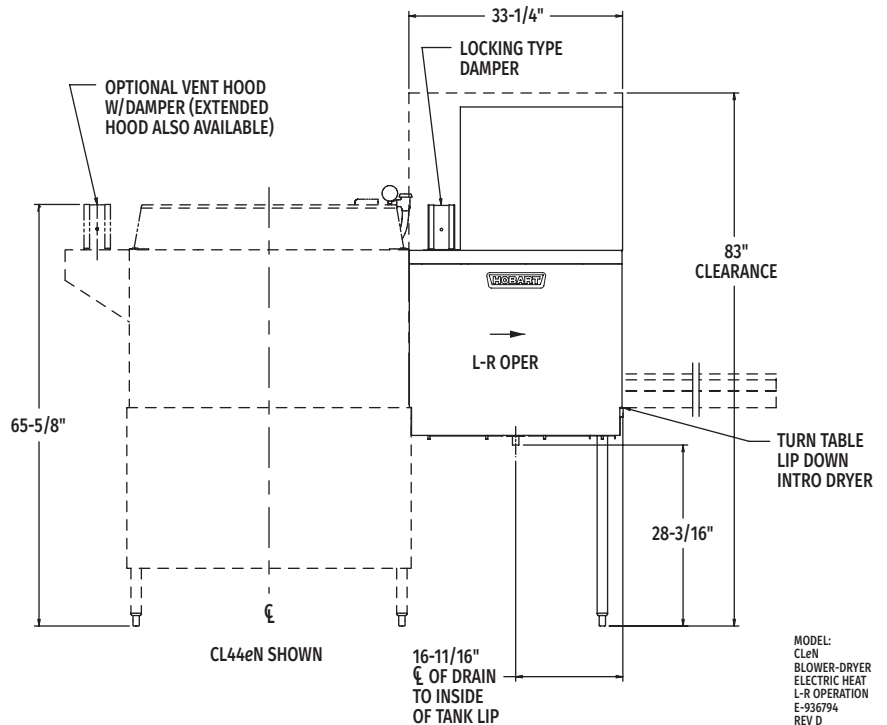
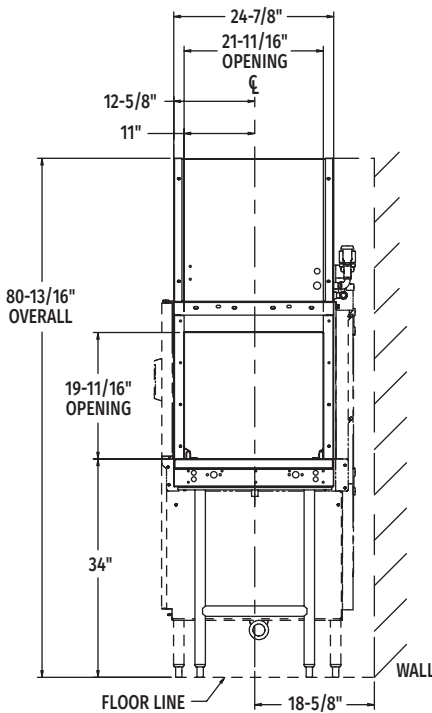
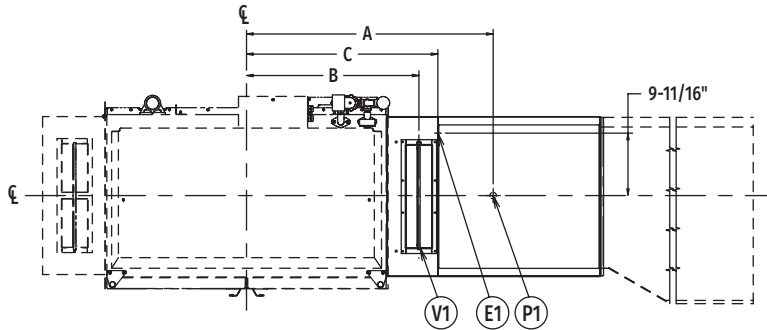
For CLeN Series

(Left to Right)

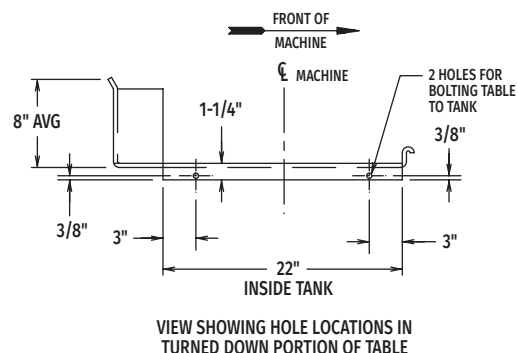
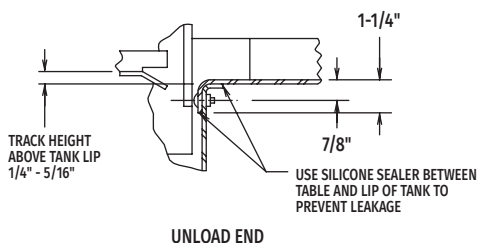
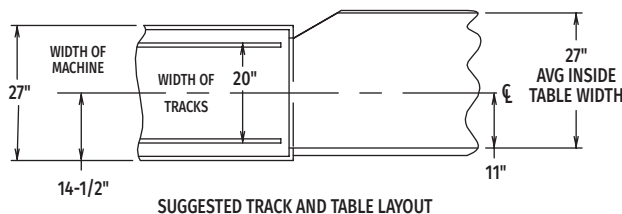
## LEGEND

Electrical Connections	
<b>E1</b>	Electric connection: Knockout made by customer, 1-1/8" conduit hole, 61" AFF.
Plumbing Connections	
<b>P1</b>	Drain connection in dryer tank: 1" FPT.
Vent Connections	
<b>V1</b>	Vent connection: (must fit inside) 4" x 16" vent stack, 400 C.F.M. exhaust.

**NOTE:** Canopy hood installation cannot be used with blower dryer.



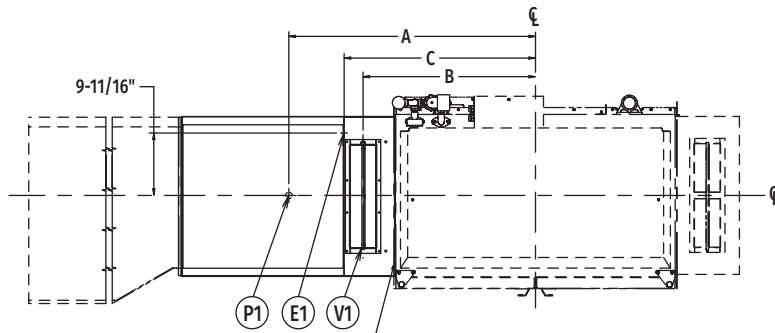
MODEL:  
CLeN  
BLOWER-DRYER  
ELECTRIC HEAT  
L-R OPERATION  
E-936794  
REV D





# ALL ELECTRIC BLOWER-DRYER ACCESSORY

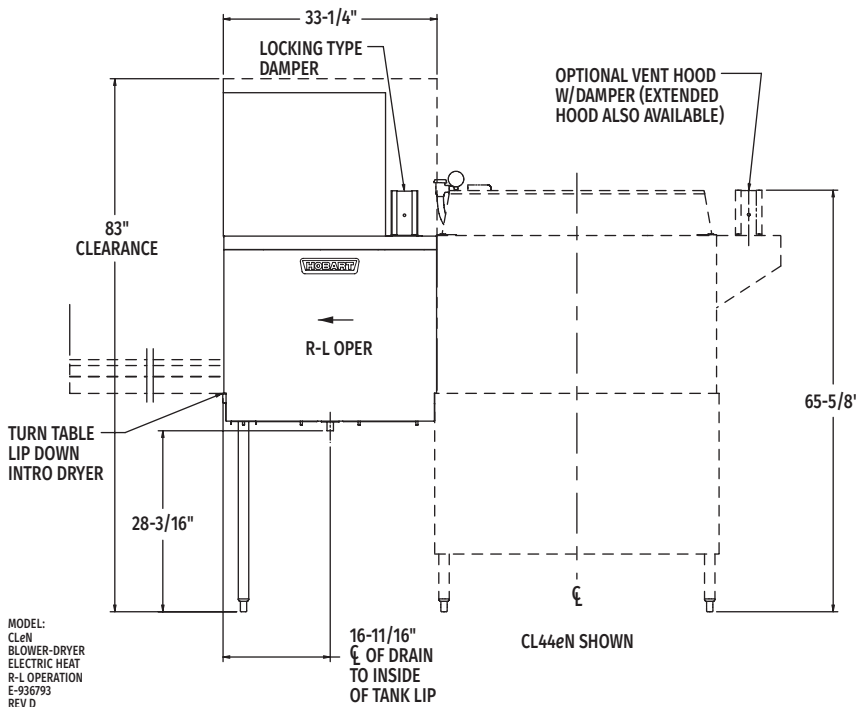
For CLeN Series  
(Right to Left)



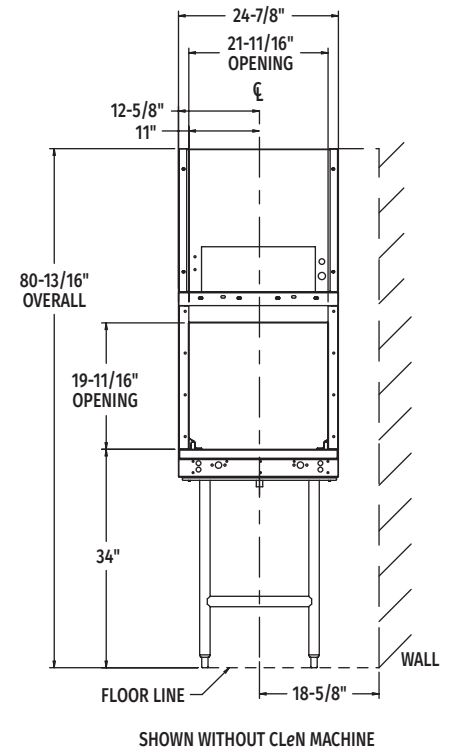
DRYER CHAMBER TO BE BOLTED TO WASH CHAMBER WITH 1/4"-20 X 5/8" HEX HEAD STAINLESS STEEL SCREWS THRU (19) 11/32" DIA. MATCHING HOLES. USE FOAM TAPE (1" WIDE X .060 THICK) AS A GASKET TO SEAL THIS JOINT.

### Single Point Electrical Connection Blower Motor & Electric Heat (3 PH only)

Electrical Specs	Rated Amps	Minimum Supply Circuit Ampacity	Maximum Protective Device
208/60/3	34.2	45	45
240/60/3	30.7	40	40
380/60/3	17.8	25	25
480/60/3	15.7	20	20
600/60/3	12.6	20	20
200/50/3	33.0	45	45
380-415/50/3	17.8	25	25



MODEL:  
CLeN  
BLOWER-DRYER  
ELECTRIC HEAT  
R-L OPERATION  
E-936793  
REV D



Model	Dimension A	Dimension B	Dimension C
CL44eN	38-7/16"	26-3/4"	29-13/16"
CLPS66eN	38-7/16"	26-3/4"	29-13/16"
CLCS66eN	38-7/16"	26-3/4"	29-13/16"
CL54eN	48-3/16"	36-5/8"	39-9/16"
CLPS76eN	48-3/16"	36-5/8"	39-9/16"
CLCS76eN	48-3/16"	36-5/8"	39-9/16"
CL64eN	48-7/16"	36-3/4"	39-13/16"
CLPS86eN	48-7/16"	36-3/4"	39-13/16"
CLCS86eN	48-7/16"	36-3/4"	39-13/16"

**WARNING:** Electrical and grounding connections must comply with the applicable portions of the National Electrical Code and/or other local electrical codes.

Plumbing connections must comply with applicable sanitary, safety and plumbing codes.

**Notes:**

1. All dimensions taken from floor line may be increased approximately 3/4" or decreased 1/2".
2. For dimensions of dishwashing machine not shown, see installation drawing of machine used.
3. Blower motor controller is controlled from dishwasher motor control box and operates with dishwasher pump motors.



## ALL ELECTRIC BLOWER-DRYER ACCESSORY

For CLeN Series

**Construction:** Chamber construction is stainless steel, welded and bolted. Vent is 4" x 16" inside dimension and contains a locking type control damper.

Stainless steel wrap-around encloses entire external component assembly consisting of electric heater, motor and blower. Blower dryer is approximately 17 $\frac{3}{8}$ " above height of machine.

Tank portion is constructed of stainless steel with legs and lower cross-members of 1 $\frac{5}{8}$ " stainless steel tubing and stainless steel adjustable feet.

Conveyor is Hobart "Dual Drive" with stainless steel pawls, designed to connect to CLeN warewasher.

**Electric Heat:** 3 - 3.3 KW Incoloy® electric heaters are used for a total of 10 KW heating capacity. Thermostatic control and separate over temperature protection are standard. Electrical specifications are 208/60/3, 240/60/3, 480/60/3, 600/60/3, 380/60/3, 200/50/3, 380-415/50/3.

**Blower:** Industrial fan-type with direct drive wheel. Housing of welded construction.

2 H.P. Blower direct drive motor. Exhaust requirement is 200 to 400 CFM.

**Motor:** Splashproof enclosure, ventilated design. Furnished only in three-phase electrical specifications of the basic CLeN Model in 208-240/60 and 480/60. The controller circuit operates on 115 volts supplied by the transformer on the dishwasher.

**Motor Control:** Ambient temperature compensated automatic resetting solid state overload protection, pre-wired. Operation controlled by dishwasher motor switch, i.e. blower functions only during machine operation.

As continued product improvement is a policy of Hobart, specifications are subject to change without notice.



**HOBART**701 S Ridge Avenue, Troy, OH 45374  
1-888-4HOBART • www.hobartservice.com**WATER SOFTENING SYSTEMS –  
WS-80****HOBART****FEATURES:****Operating Profile**

Softener will remove hardness to less than 1/2 gpg when operated in accordance with the operating instructions. The system includes two tanks. This duplex configuration operates with one tank on-line during service. During regeneration cycles, one tank provides water to service and to the regenerating tank. A water meter initiates system regeneration. The water meter measures the processed volume and is adjustable. Service flow is down-flow and regeneration flow is up-flow.

**Regeneration Control Valve**

The regeneration control valve is top mounted (top of media tank), and manufactured from non-corrosive materials. Control valve does not weigh more than four pounds. Control valve provides service and regeneration control for two media tanks. Inlet and outlet ports accept a quick connect, double o-ring sealed adapter. Interconnection between tanks is made through the regeneration valve with a quick connect adapter. Control valve operates using a minimum inlet pressure of 15 psi. Pressure is used to drive all valve functions. No electric hook-up is required. Control valve will incorporate four operational cycles including; service, brine draw, slow rinse, and a combined fast rinse and brine refill. Service cycle operates in a down-flow direction. The brine cycle flows up-flow, opposite the service flow, providing a countercurrent regeneration. Control valve contains a fixed orifice eductor nozzle and self-adjusting backwash flow control. The control valve will prevent the bypass of hard water to service during the regeneration cycle.

**Media Tanks**

The tanks are designed for a maximum working pressure of 125 psi and hydrostatically tested at 300 psi. Tanks are made of engineered plastic with a 2.5 in. threaded top opening. Each tank is NSF approved. Upper distribution system is of a slot design. Lower distribution system is of a flat plate design. Distributors will provide even flow of regeneration water and the collection of processed water.

**Conditioning Media**

Each softener includes uniform bead cation resin having a minimum exchange capacity of 30,000 grains/ft<sup>3</sup> when regenerated with 15.0 lbs/ft<sup>3</sup>. The media is solid, of a proper particle size and contains no plates, shells, agglomerates or other shapes, which might interfere with the normal function of the water softener.

**Brine System**

A combination salt storage and brine production tank is manufactured of corrosion resistant, plastic. The brine tank has a chamber to house the brine valve assembly. The brine float assembly allows for adjustable salt settings and provides for a shut-off to the brine refill. The brine tank includes a safety overflow connection to be plumbed to a suitable drain.

**Salt Alarm**

Salt alarm consists of an alarm box and a brine sensor. Brine sensor is mounted internally on the grid plate and operates on the specific gravity of proper brine concentration. An alarm condition is triggered when the concentration falls below acceptable level for more than 15 minutes. The alarm is both an 80-db audible alarm every 3 seconds and a red LED flash every 7 seconds. The alarm box operates on three AA batteries and connects to the brine sensor with a standard 2-wire phone cord (7' phone cord supplied).

**MODEL:** **Model WS-80**

Specifications, Details and Dimensions on Back.

**Model WS-80****Salt Alarm****WATER SOFTENING SYSTEMS - WS-80**

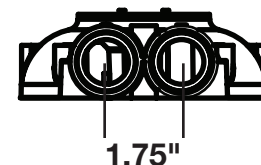
# WATER SOFTENING SYSTEMS – WS-80



701 S Ridge Avenue, Troy, OH 45374  
1-888-4HOBART • www.hobartservice.com

## System Components

Media Vessel (qty) Size .....(2) 8 x 17"  
Media Vessel Construction .....Fiberglass Wrapped Engineered Plastic  
Empty Bed Volume .....0.40 ft<sup>3</sup>  
Media Type .....Uniform Bead Cation Resin  
Media Volume .....0.40 ft<sup>3</sup>  
Bed Depth .....Packed  
Free Board ..... None  
Riser Tube .....1" CPVC  
Distributor  
Upper .....0.012" Slots, Engineered Plastic Basket  
Lower .....0.009" Slots, Stainless Steel Flat Plate  
Under bedding .....None  
Regeneration Control .....Non-electric Use Meter  
Regeneration Type .....Countercurrent  
Meter Type .....0.30 - 25.00 gpm Polypropylene Turbine



## Inlet Water Quality

Pressure Range .....15 – 125 psi Dynamic Pressure  
Temperature Range .....35 – 160° F  
Temperature (Continuous) .....150° F  
pH Range .....5 – 10 SU  
Free Chlorine Cl<sub>2</sub> (Max.) .....2.0 mg/l  
Hardness as CaCO<sub>3</sub> (Max.) .....40 gpg

## Operating Specs

Flow Range (15 / 30 psig) .....10.2 – 16.4 gpm  
Flow Configuration .....Alternating  
Dimensions (width x depth x height) .....20 x 22 x 28"  
Weight (Operating / Shipping) .....220 / 100 lbs.

## Connections

Inlet / Outlet Connections .....Custom Adapter and Bracket  
Drain Connection .....0.5" Tube  
Brine Line Connection .....0.375" Tube (internal)  
Overflow Connection .....0.5" Tube  
Power .....None  
Salt Alarm.....3 AA Batteries

## System Part Numbers

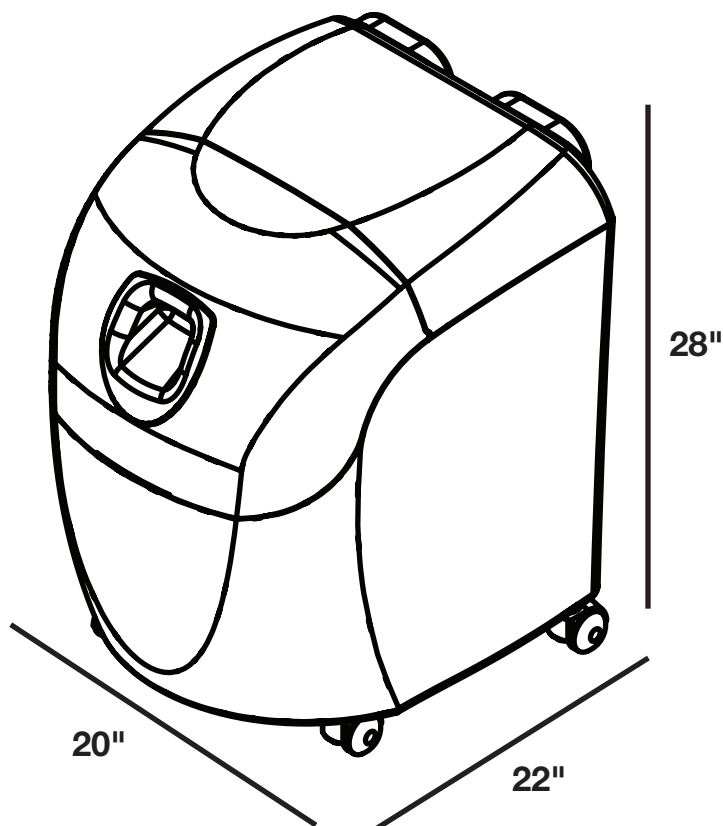
WS-80, Compact Cabinet Softener .....913091-125

## Brine Tank Options

Tank Description .....208 Cabinet  
Tank Height .....28"  
Tank Footprint .....20 x 22"  
Material .....HDPE  
Salt Capacity .....80 lbs.

## Regeneration Specifications

Regeneration Volume .....14 gallons  
Regeneration Time .....11 minutes  
Backwash Flow Control .....1.40 gpm  
Brine Refill Flow Control .....0.40 gpm



## Disc Selection

(Compensated Hardness\*)

Setting	Capacity	Efficiency	Dosing	Meter Disc	1	2	3	4	5	6	7	8
1.4 lbs.	4,818 grains	3,442 gr./lb.	3.5 lbs./ft <sup>3</sup>		5	11	17	22	27	32	35	40
				<b>Gallons/Regeneration:</b>	732	366	244	183	146	122	105	92
				<b>Flow during regeneration (@ 15 psig):</b>	10.2	10.2	10.2	10.2	10.2	8.3	6.7	5.5

\*Compensated hardness in gpg = Hardness + (3 x Fe in mg/l)

As continued product improvement is a policy of Hobart, specifications are subject to change without notice.



***Submittal Sheet***

01/09/2023

**ITEM# 14 - CLEAN DISH TABLE (1 EA REQ'D)**  
(HOBART)  
cost included in item #8



## ***Submittal Sheet***

01/09/2023

### **ITEM# 15 - SHELVING, WALL MOUNTED (1 EA REQ'D)**

Eagle Group WS1284-16/3

Shelf, wall-mounted, 84"W x 12"D, rolled frontedge, 1-1/2"H up-turn on sides & rear, includes stainless steel mounting brackets stud welded to shelf, 16/304 stainless steel construction, NSF



Profit from the Eagle Advantage®

## Specification Sheet

### Short Form Specifications

Eagle Wall Shelf, model \_\_\_\_\_. Constructed of 16 gauge type 430, 16 gauge type 304, or 14 gauge type 304 stainless steel. 1½" roll on front, with 1½" upturn on rear and ends. Stainless steel mounting brackets are stud welded to shelf.



#WS1236-16/3 wall shelf

Item No.:	_____
Project No.:	_____
S.I.S. No.:	_____

## Wall Shelves

### MODELS:

- |                                    |                                    |
|------------------------------------|------------------------------------|
| <input type="checkbox"/> WS1024-*  | <input type="checkbox"/> WS1224-*  |
| <input type="checkbox"/> WS1036-*  | <input type="checkbox"/> WS1236-*  |
| <input type="checkbox"/> WS1048-*  | <input type="checkbox"/> WS1248-*  |
| <input type="checkbox"/> WS1060-*  | <input type="checkbox"/> WS1260-*  |
| <input type="checkbox"/> WS1072-*  | <input type="checkbox"/> WS1272-*  |
| <input type="checkbox"/> WS1084-*  | <input type="checkbox"/> WS1284-*  |
| <input type="checkbox"/> WS1096-*  | <input type="checkbox"/> WS1296-*  |
| <input type="checkbox"/> WS10108-* | <input type="checkbox"/> WS12108-* |
| <input type="checkbox"/> WS10120-* | <input type="checkbox"/> WS12120-* |

\* See chart on back page for complete model numbers.

### Wall Mounted Shelves

- 1½" (38mm) roll on front.
- 1½" (38mm) upturn on rear and ends.
- Die-formed stainless steel mounting brackets are stud-welded to shelf.
- All stainless steel polished to #4 finish.
- Available in 16 gauge type 430, 16 gauge type 304, and 14 gauge type 304 stainless steel.
- Wide selection of sizes.

### EAGLE GROUP

100 Industrial Boulevard, Clayton, DE 19938-8903 USA

Phone: 302-653-3000 • Fax: 302-653-2065

www.eaglegrp.com

Foodservice Division: Phone 800-441-8440

MHC/Retail Display Divisions: Phone 800-637-5100

For custom configuration or fabrication needs, contact our SpecFAB® Division.

Phone: 302-653-3000 • Fax: 302-653-2065 • e-mail: quotes@eaglegrp.com

### Certifications / Approvals



### AUTOQUOTES



EG02.05 Rev. 09/13

Spec sheets available for viewing, printing or downloading from our online literature library at [www.eaglegrp.com](http://www.eaglegrp.com)

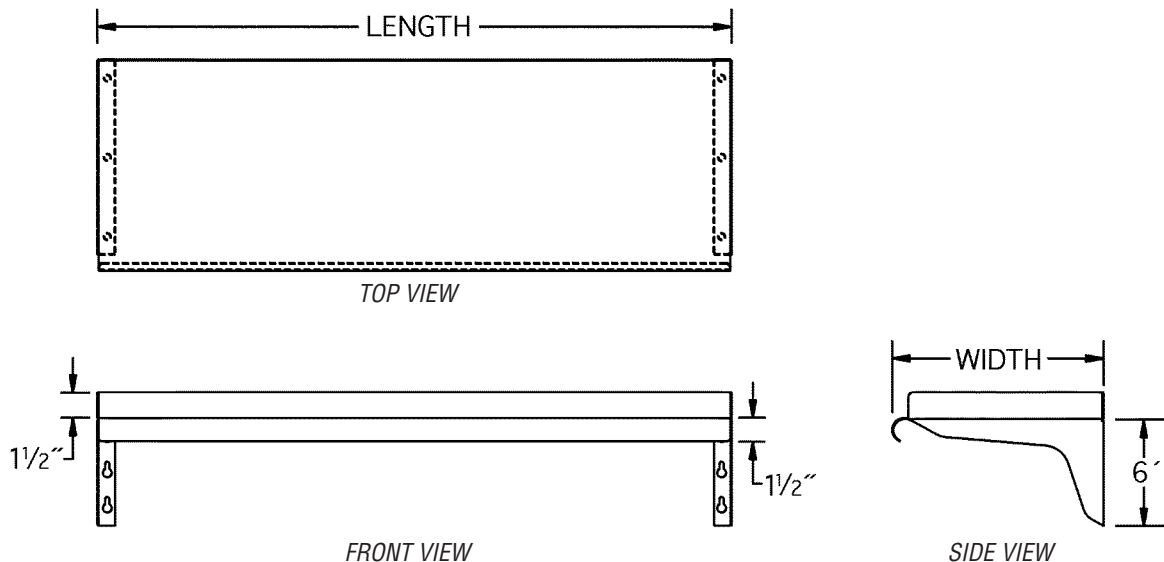
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Profit from the Eagle Advantage®

Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

## Wall Mounted Shelves



16 gauge type 430 model #	16 gauge type 304 model #	14 gauge type 304 model #	width*		length		weight	
			in.	mm	in.	mm	lbs.	kg
WS1024-16/4	WS1024-16/3	WS1024-14/3	10"	254	24"	610	10	4.5
WS1036-16/4	WS1036-16/3	WS1036-14/3	10"	254	36"	914	12	5.4
WS1048-16/4	WS1048-16/3	WS1048-14/3	10"	254	48"	1219	15	6.8
WS1060-16/4	WS1060-16/3	WS1060-14/3	10"	254	60"	1524	20	9.0
WS1072-16/4	WS1072-16/3	WS1072-14/3	10"	254	72"	1829	22	10.0
WS1084-16/4	WS1084-16/3	WS1084-14/3	10"	254	84"	2134	24	10.9
WS1096-16/4	WS1096-16/3	WS1096-14/3	10"	254	96"	2438	29	13.2
WS10108-16/4	WS10108-16/3	WS10108-14/3	10"	254	108"	2743	32	14.5
WS10120-16/4	WS10120-16/3	WS10120-14/3	10"	254	120"	3048	34	15.4
WS1224-16/4	WS1224-16/3	WS1224-14/3	12"	305	24"	610	12	5.4
WS1236-16/4	WS1236-16/3	WS1236-14/3	12"	305	36"	914	14	6.4
WS1248-16/4	WS1248-16/3	WS1248-14/3	12"	305	48"	1219	17	7.7
WS1260-16/4	WS1260-16/3	WS1260-14/3	12"	305	60"	1524	23	10.4
WS1272-16/4	WS1272-16/3	WS1272-14/3	12"	305	72"	1829	25	11.3
WS1284-16/4	WS1284-16/3	WS1284-14/3	12"	305	84"	2134	28	12.7
WS1296-16/4	WS1296-16/3	WS1296-14/3	12"	305	96"	2438	31	14.1
WS12108-16/4	WS12108-16/3	WS12108-14/3	12"	305	108"	2743	36	16.3
WS12120-16/4	WS12120-16/3	WS12120-14/3	12"	305	120"	3048	39	17.6

\* 15" and 18" (381 and 457mm)-wide shelves available. To order, replace "12" in model number with a "15" or "18" indicating shelf width. Example: WS1536-16/3

### EAGLE GROUP

100 Industrial Boulevard, Clayton, DE 19938-8903 USA

Phone: 302-653-3000 • Fax: 302-653-2065

www.eaglegrp.com

Foodservice Division: Phone 800-441-8440

MHC/Retail Display Divisions: Phone 800-637-5100

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Rev. 09/13

Spec sheets available for viewing, printing or downloading from our online literature library at [www.eaglegrp.com](http://www.eaglegrp.com)

Although every attempt has been made to ensure the accuracy of the information provided, we cannot be held responsible for typographical or printing errors. Information and specifications are subject to change without notice. Please confirm at time of order.



## ***Submittal Sheet***

01/09/2023

### **ITEM# 16 - RACK DOLLY (3 EA REQ'D)**

Eagle Group GRDH-2020-A

Panco® Glass Rack Dolly, with handle, open frame design, single stack, for 20" x 20" racks, heavy duty welded, all aluminum construction, 5" non-marking swivel plate casters, 1200 lb. capacity, NSF



## Submittal Sheet

01/09/2023

### ITEM# 17 - TRAY RACK DISPENSER (2 EA REQ'D)

Delfield TT2-1622

Dispenser, Tray, open frame mobile design, dual self-elevating tray platforms, for 16" x 22" trays, 4" casters, NSF ACCESSORIES

Mfr	Qty	Model	Spec
Delfield	2		NOTE: Freight quotes are only valid from Delfield
Delfield	2	0460000N	1 year parts & labor warranty, standard



# Shelleymatic by Delfield

## TT/TT2

Mobile Open Frame Tray And Rack Dispensers

Project \_\_\_\_\_  
 Item \_\_\_\_\_  
 Quantity \_\_\_\_\_  
 CSI Section 11400  
 Approved \_\_\_\_\_  
 Date \_\_\_\_\_

TT/TT2

Mobile Open Frame Tray And Rack Dispensers

### Models

- TT-1014 One stack, 11"x15" trays
- TT-1216 One stack, 12"x16" trays
- TT-1221 One stack, 12"x21" trays
- TT-1418 One stack, 14"x18" trays
- TT-1422 One stack, 14"x22" trays
- TT-1622 One stack, 16"x22" trays
- TT-1826 One stack, 18"x26" trays
- TT-2020 One stack, 20"x21" trays
- TT2-1014 Two stack, 11"x15" trays
- TT2-1216 Two stack, 12"x16" trays
- TT2-1221 Two stack, 12"x21" trays
- TT2-1418 Two stack, 14"x18" trays
- TT2-1422 Two stack, 14"x22" trays
- TT2-1622 Two stack, 16"x22" trays
- TT2-1826 Two stack, 18"x26" trays
- TT2-2020 Two stack, 20"x21" trays



TT-1422

### Standard Features

- Tubing and base to be 16-gauge stainless steel
- Tubing and base to be integrally welded
- Base to be reinforced with 14-gauge stainless steel angles
- Non-marring gray corner bumpers
- (4) 4.00" diameter Polyurethane swivel casters (all locking)
- Dispenser platform carrier shall be 18-gauge stainless steel
- Self-leveling mechanisms shall be adjustable by adding and removing stainless steel extension springs located inside the elevator housing
- Each dispenser section holds approximately 50-60 trays (varies per tray style)
- One year parts and 90 day labor standard warranty

### Options & Accessories

- Flange-mount feet in lieu of casters
- Napkin dispensers
- Six- or eight-hole silverware bins with plastic or stainless steel cylinders
- Wrap-around bumpers (adds 1.75" [4.4cm] to overall length and depth)
- Dust cover

### Specifications

**Framework** shall be integrally welded 1.00" (2.5cm) O.D. 16-gauge stainless steel tubing welded to a 16-gauge stainless steel base. Frame shall have stainless steel horizontal support rods affixed to the tubing. Base shall be reinforced with full-length 14-gauge stainless steel angles.

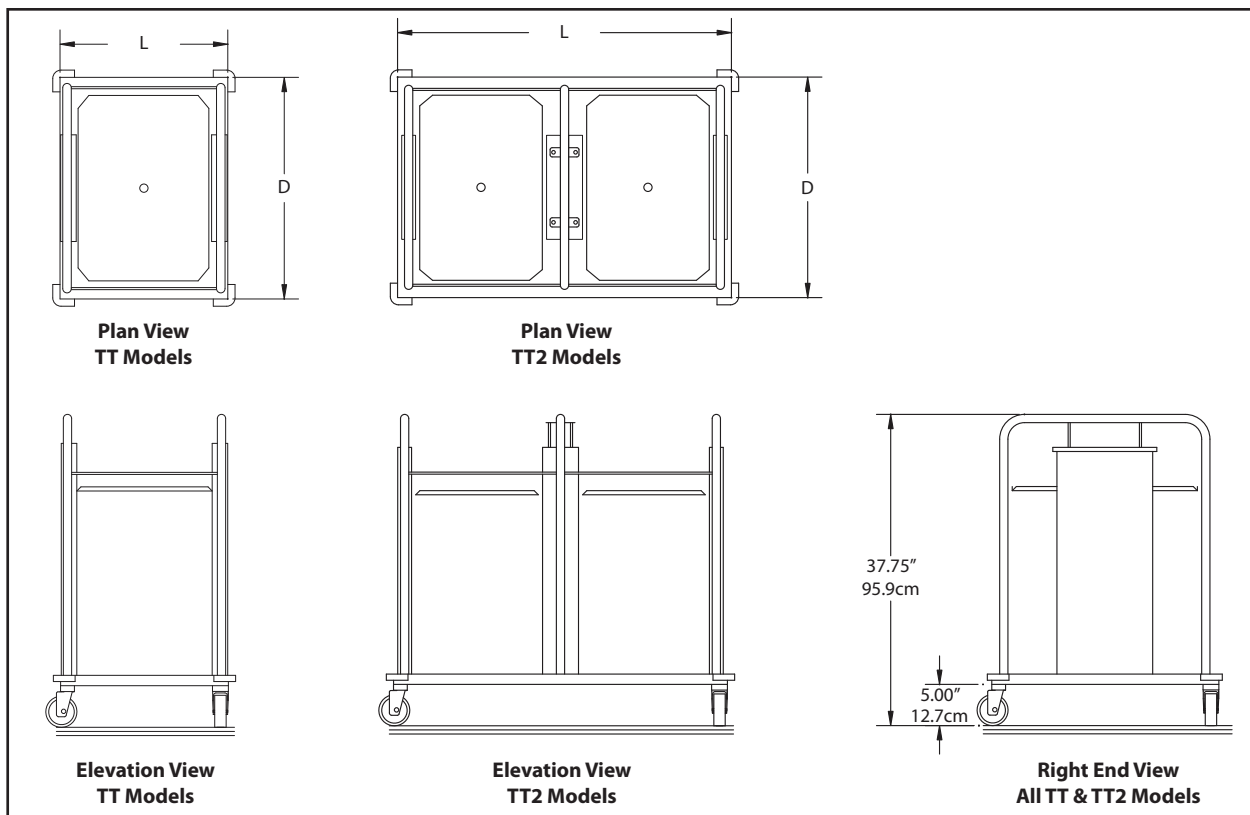
**Castors:** Unit shall have four 4.00" (10.2cm) diameter Polyurethane swivel casters (all locking) (5.00" [12.7cm] ride height) and non-marking gray bumpers at each corner.

**Dispenser** platform carries shall be 18-gauge stainless steel and shall be removable for cleaning. Each dispenser shall have 2 self-leveling mechanisms.

**Self-leveling** mechanisms shall be field adjustable by adding or removing stainless steel extension springs located inside the elevator housing.



# Shelleymatic by Delfield



Specifications

Model	Length	Depth	Maximum Tray Size	Ship Weight
TT-1014	21.25" (54.0cm)	15.25" (38.7cm)	11" x 15" (27.9cm x 38.1cm)	102lbs/46kg
TT-1216	18.25" (46.4cm)	20.75" (52.7cm)	12" x 16" (30.5cm x 40.6cm)	102lbs/46kg
TT-1221	18.25" (46.4cm)	25.75" (65.4cm)	12" x 21" (30.5cm x 53.3cm)	105lbs/48kg
TT-1418	20.25" (51.4cm)	22.75" (57.8cm)	14" x 18" (35.6cm x 45.7cm)	102lbs/46kg
TT-1422	20.25" (51.4cm)	26.75" (67.9cm)	14" x 22" (35.6cm x 55.9cm)	105lbs/48kg
TT-1622	22.25" (56.5cm)	26.75" (67.9cm)	16" x 22" (40.6cm x 55.9cm)	106lbs/48kg
TT-1826	24.25" (61.6cm)	30.75" (78.1cm)	18" x 26" (45.7cm x 66.0cm)	111lbs/50kg
TT-2020	26.25" (66.7cm)	25.75" (65.4cm)	20" x 21" (50.8cm x 53.3cm)	111lbs/50kg
TT2-1014	21.25" (54.0cm)	26.75" (67.9cm)	11" x 15" (27.9cm x 38.1cm)	113lbs/51kg
TT2-1216	36.50" (92.7cm)	20.75" (52.7cm)	12" x 16" (30.5cm x 40.6cm)	165lbs/75kg
TT2-1221	36.50" (92.7cm)	25.75" (65.4cm)	12" x 21" (30.5cm x 53.3cm)	163lbs/74kg
TT2-1418	40.50" (102.9cm)	22.75" (57.8cm)	14" x 18" (35.6cm x 45.7cm)	165lbs/75kg
TT2-1422	40.50" (102.9cm)	26.75" (67.9cm)	14" x 22" (35.6cm x 55.9cm)	163lbs/74kg
TT2-1622	44.50" (113.0cm)	26.75" (67.9cm)	16" x 22" (40.6cm x 55.9cm)	170lbs/77kg
TT2-1826	48.50" (123.2cm)	30.75" (78.1cm)	18" x 26" (45.7cm x 66.0cm)	179lbs/81kg
TT2-2020	52.50" (133.4cm)	25.75" (65.4cm)	20" x 21" (50.8cm x 53.3cm)	179lbs/81kg

**NOTES:**

- Standard corner bumpers add 1.75" (4.4cm) to overall length and width.
- TT2 models dispense two separate stacks of trays.

Delfield reserves the right to make changes to the design or specifications without prior notice.

TT/TT2 Mobile Open Frame Tray And Rack Dispensers

980 S. Isabella Rd.  
Mt. Pleasant, Michigan 48858

Phone: 800-733-8948 or 989-773-7981  
Fax: 800-669-0619  
www.delfield.com

Printed in the U.S.A.  
5927  
08/15





## ***Submittal Sheet***

01/09/2023

### **ITEM# 17 - TRAY RACK DISPENSER (2 EA REQ'D)**

Carter-Hoffmann ETD2S1520

Enclosed tray dispenser; 2 stack; for 15"x20" trays; all stainless steel exterior, adjustable to different tray types; 5" all swivel casters with pulley style self-leveling system.

<Alternate>

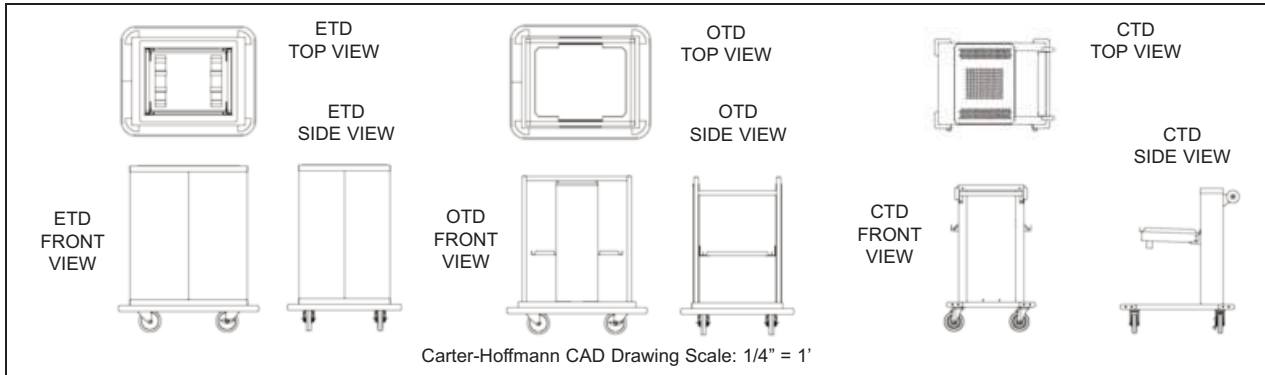


# TRAY DISPENSERS

## Mobile Dispenser Carts

### Enclosed, Open and Cantilever Styles

CARTER-HOFFMANN  
**11**  
 FOOD SERVICE EQUIPMENT  
 TRAY DISPENSERS



Model Number	Tray Size		Description	Overall Dimensions			Caster Diameter		Shipping Weight				
	in	mm		Height in mm	Depth in mm	Width in mm	in	mm	lbs	kg			
<input type="checkbox"/> ETD1418	14 x 18	356 x 457	Enclosed single stack	38	965	21	533	27	686	5	127	150	68
<input type="checkbox"/> ETD1520	15 x 20	381 x 508	Enclosed single stack	38	965	21	533	27	686	5	127	150	68
<input type="checkbox"/> ETD1622	16 x 22	406 x 559	Enclosed single stack	38	965	21	533	27	686	5	127	150	68
<input type="checkbox"/> ETD2S1418	14 x 18	356 x 457	Enclosed double stack	38	965	41	1041	27	686	5	127	300	136
<input type="checkbox"/> ETD2S1520	15 x 20	381 x 508	Enclosed double stack	38	965	41	1041	27	686	5	127	300	136
<input type="checkbox"/> ETD2S1622	16 x 22	406 x 559	Enclosed double stack	38	965	41	1041	27	686	5	127	300	136
<input type="checkbox"/> OTD1418	14 x 18	356 x 457	Open single stack	36	914	21	533	27	686	5	127	140	64
<input type="checkbox"/> OTD1520	15 x 20	381 x 508	Open single stack	36	914	21	533	27	686	5	127	140	64
<input type="checkbox"/> OTD1622	16 x 22	406 x 559	Open single stack	36	914	21	533	27	686	5	127	140	64
<input type="checkbox"/> OTD2S1418	14 x 18	356 x 457	Open double stack	36	914	43	1092	27	686	5	127	150	68
<input type="checkbox"/> OTD2S1520	15 x 20	381 x 508	Open double stack	36	914	43	1092	27	686	5	127	150	68
<input type="checkbox"/> OTD2S1622	16 x 22	406 x 559	Open double stack	36	914	43	1092	27	686	5	127	150	68
<input type="checkbox"/> CTD1222	12 x 22	305 x 559	Cantilever single stack	37 <sup>5</sup> / <sub>8</sub>	956	21	533	27 <sup>3</sup> / <sub>4</sub>	705	5	127	150	68
<input type="checkbox"/> CTD1321	13 x 21	330 x 533	Cantilever single stack	37 <sup>5</sup> / <sub>8</sub>	956	21	533	27 <sup>3</sup> / <sub>4</sub>	705	5	127	150	68
<input type="checkbox"/> CTD1418	14 x 18	356 x 457	Cantilever single stack	37 <sup>5</sup> / <sub>8</sub>	956	21	533	27 <sup>3</sup> / <sub>4</sub>	705	5	127	150	68
<input type="checkbox"/> CTD1520	15 x 20	381 x 508	Cantilever single stack	37 <sup>5</sup> / <sub>8</sub>	956	21	533	27 <sup>3</sup> / <sub>4</sub>	705	5	127	150	68
<input type="checkbox"/> CTD1622	16 x 22	406 x 559	Cantilever single stack	37 <sup>5</sup> / <sub>8</sub>	956	21	533	27 <sup>3</sup> / <sub>4</sub>	705	5	127	150	68
<input type="checkbox"/> CTD RS	13.5 x 23	343 x 584	Cantilever single stack	37 <sup>5</sup> / <sub>8</sub>	956	21	533	27 <sup>3</sup> / <sub>4</sub>	705	5	127	150	68

**CONSTRUCTION: ENCLOSED DISPENSERS...** Completely welded cabinet construction with outer cabinet formed and welded to base. Built-in stainless tray platform. All stainless steel construction with polished exterior.

**CONSTRUCTION: CANTILEVER DISPENSERS...** All stainless steel with stainless steel lowerator housing, bottom and tray platform.

**CONSTRUCTION: OPEN DISPENSERS...** High strength stainless steel tubular frame with solid stainless steel bottom and tray platform.

**BASE FRAME...** 12 gauge stainless steel full depth caster bolsters with 1" x 1" 14 gauge stainless steel channels welded to bolsters.

**CASTERS...** 5" diameter, all swivel ball bearing type casters, plate mounted and bolted to frame. Two casters fitted with brakes. Wheel-ahead caster pattern.

**STYLING...** All stainless steel with red custom colored matching casters and bumper vinyl.

**DISPENSER PLATFORM...** Field adjustable springs to accommodate differences in tray weights and heights. Number of connected springs can be increased or decreased to change the platform tension release tension in 2.5 oz/in. Disconnected springs remain in place and out of the way. All stainless steel platform.

- OPTIONS AND ACCESSORIES...**
- Wrap-around extruded aluminum bumper with non-marking vinyl insert; specify red or grey (ETD and OTD only)
  - Four soft durometer cushioned corner bumpers

# SPECIFICATIONS

Specifications subject to change through product improvement & innovation.

## CARTER-HOFFMANN

1551 McCormick Ave., Mundelein, IL 60060  
 (847) 362-5500 • (800) 323-9793 • Fax (847) 367-8981  
[www.carter-hoffmann.com](http://www.carter-hoffmann.com)



# FEATURES & BENEFITS

## TRAY DISPENSERS

*Since 1947, foodservice equipment that delivers!*



**ETD1520**

(shown with optional wrap-around bumper)

**ETD: COMPLETELY WELDED TURNED-IN SEAM CONSTRUCTION...** All stainless steel construction. Adds rigidity to entire cabinet for maximum durability and reliable performance, and eliminates raw edges for easy cleaning and safety. Sleek exterior styling is easy to clean.



**OTD1520**

(shown with optional wrap-around bumper)

**OTD: ALL STAINLESS STEEL TUBULAR FRAME...** Heavy-duty stainless steel frame with stainless steel bottom and tray platform.



**CTD1520**

(shown with optional corner bumpers)

**CTD: ALL STAINLESS STEEL...** Heavy-duty stainless steel lowerator housing with stainless steel bottom and tray platform.

**RUBBER TREAD CASTERS WITH SEALED ROLLER BEARING...**

Long lasting, easy rolling for maximum load and minimum maintenance. All swivel casters fitted with brakes.



**ADJUSTABLE TRAY PLATFORM...**

Field adjustable springs to accommodate differences in tray weights and heights. Number of connected springs can be increased or decreased to change the platform tension.



1551 McCormick Avenue, Mundelein, Illinois 60060  
Tel. (847)362-5500 • (800)323-9793 • Fax (847)367-8981  
[www.carter-hoffmann.com](http://www.carter-hoffmann.com)





***Submittal Sheet***

01/09/2023

**ITEM# 18 - DISH CART / DOLLY (3 EA REQ'D)**

Cambro TDC2029615

Dish Cart Only, 38-1/8"L x 22-1/4"W x 34-1/4"H, (4) 6" swivel casters, polyethylene, charcoal gray, NSF

**CAMBRO****Tray and Dish Cart***Cart and Cutlery Rack*

Model TDCR12

*Cart Only*

Model TDC2029

**Features & Benefits**

- From kitchen to serving line, this cart streamlines self-service operations and provides compact sanitary storage. Holds a variety of plates, trays and cutlery.
- Made of single-molded, seamless, double-wall, high-density polyethylene construction.
- Easy to clean and impact resistant. Won't rust, peel, crack or dent.
- Foamed-in polyurethane insulation adds structural strength and reduces noise.
- Rounded corners protect walls.
- Available with or without detachable 12-Compartment Cutlery Rack CR12.
- Includes 12 flatware cylinders.
- Molded-in handles on both sides ensure easy & comfortable handling.
- Four 6" (15,2 cm) swivel casters, 2 w/ brakes, provide easy maneuvering.
- Convenient vinyl cover included for added protection and more sanitary storage. Cover is not NSF listed.
- No assembly required.
- Available in 6 colors.

Item No. \_\_\_\_\_

Specifier Identification No. \_\_\_\_\_

Model No. \_\_\_\_\_

Quantity \_\_\_\_\_



TDCR12



TDC2029

**Approvals**

**CAMBRO**  
MANUFACTURING COMPANY  
<http://www.cambro.com>

© 2008 Cambro Manufacturing Company 5801 Skylab Road, Huntington Beach, California 92647-2056-U.S.A.  
Telephone (1)714 848 1555 Toll Free 800 854 7631 Customer Service 800 833 3003  
LIT FCST-0102-42

# Tray and Dish Cart

*Cart and Cutlery Rack*

Model TDCR12

*Cart Only*

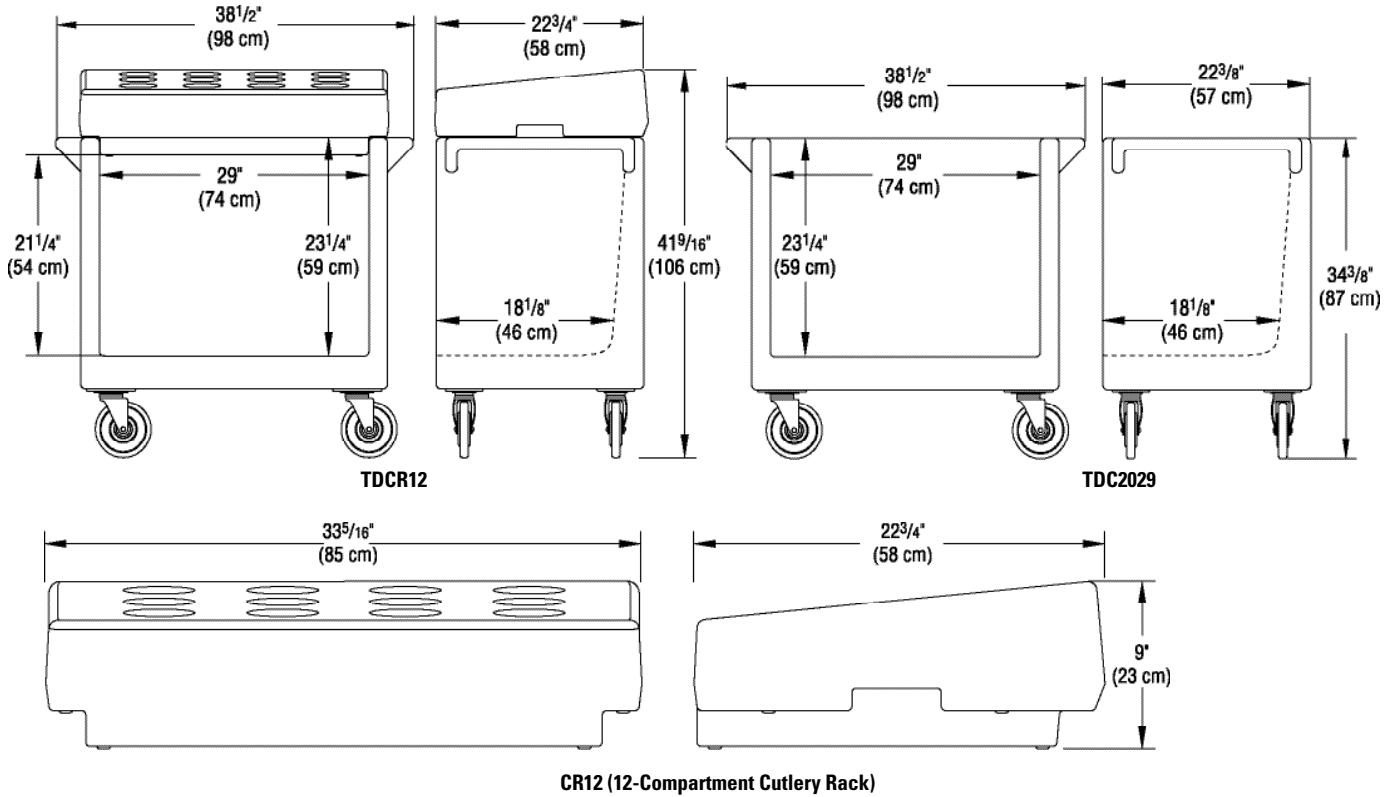
Model TDC2029

**Item No.** \_\_\_\_\_

**Specifier Identification No.** \_\_\_\_\_

**Model No.** \_\_\_\_\_

**Quantity** \_\_\_\_\_



## Specifications

Dimension Tolerance: +/- 1/4" (0,64 cm)

Code	Description	Exterior Dimensions W x D x H	Case lbs./cube Kg/m <sup>3</sup>
TDCR12	Cart & Cutlery Rack Combination	38 1/2" x 22 3/4" x 41 9/16" (98 x 58 x 106 cm)	88,5 (22,23) 40,5 (0,63)
TDC2029	Cart only	38 1/2" x 22 3/8" x 34 3/8" (98 x 57 x 87 cm)	65 (18,80) 29,5 (0,3)

## Optional Accessories

- 12-Compartment Cutlery Rack**  CR12  
W x D x H 33 5/16" x 22 3/4" x 9" (85 x 58 x 23 cm)
  - Replacement Vinyl Cover**  RDC2029C (1 included with cart)
- \*Note: Vinyl Cover is not NSF listed.

## Standard Colors

- Slate Blue (401)
- Dark Brown (131)
- Coffee Beige (157)
- Gray (180)
- Granite Green (192)
- Granite Gray (191)

## Architect Specs

The Tray and Dish Cart shall be Cambro Model..., manufactured by Cambro Mfg. Co., Huntington Beach, CA 92648 U.S.A. It shall be single-molded, seamless, double-wall, high density polyethylene and foam injected polyurethane. It shall have rounded corners and molded-in handles. It shall have four each 6" (15,2 cm) swivel casters, 2 w/ brakes, mounted on molded-in impact plates. It shall have a detachable 12-compartment Cutlery Rack. It shall have a vinyl cover included for added protection and sanitary storage and shall be available in 6 colors.

## Approvals





# TRAY & DISH CARTS / TRAY & SILVERWARE CART

## Tray & Dish Cart

- Open storage compartment holds a wide variety of plates and trays.
- Use with or without detachable cutlery rack. Cutlery rack includes 12 each flatware cylinders.
- Made of easy-to-clean polyethylene that won't rust, peel or corrode.
- Molded-in handles and heavy-duty swivel casters ease maneuvering.

**Colors:** Slate Blue (401), Coffee Beige (157), Dark Brown (131), Granite Gray (191), Granite Green (192), Black (110).

**6" Casters:** All swivel, 2 with brake.

**Maximum load capacity:** 500 lbs.

Vinyl cover included. Not NSF listed.



TDCR12

CODE	DESCRIPTION	DIMENSIONS L x W x H
TDCR12	Cart and rack combination	38 3/8" x 22 3/4" x 41 1/4"
TDC2029*	Cart only	38 3/8" x 22 3/4" x 34 1/4"
CR12	Cutlery rack only	33" x 22 3/4" x 9"
FWC56	Flatware cylinder	—

Case Pack: 1 FWC56 Case Pack: 12 \*TDC2029 is not available in Black (110).

## Adjustable Tray & Dish Cart

- Use to store a wide variety of plates and trays.
- Move two adjustable dividers into position easily to secure trays and plates.

- Made of durable polyethylene that cushions plates and trays to prevent chipping.
- Easy to clean and won't dent, rust, chip or break.

**Colors:** Black (110), Slate Blue (401), Coffee Beige (157), Dark Brown (131), Granite Gray (191), Granite Green (192).

**6" Casters:** All swivel, 2 with brake.

**Maximum load capacity:** 500 lbs.

Vinyl cover included. Not NSF listed.



TDC30

CODE	DESCRIPTION	EXTERIOR DIMENSIONS L x W x H	NUMBER OF DIVIDERS	PLATES PER COLUMN	TRAYS PER COLUMN
TDC30	Adjustable cart	23 1/4" x 38 3/8" x 34 1/2"	2	Approximately 45-60 plates	80 trays: 14" x 18"

Case Pack: 1

## Tray & Silverware Cart

- Use to neatly organize trays and accessories for self-service.
- Includes 4 each 1/3 size and 4 each 1/6 size, 4" deep, clear Camwear® food pans to hold flatware, napkins and non-perishable condiments. 1/3 size, 4" deep holds 100 knives, 100 spoons or 80 forks.

**Colors:** Slate Blue (401), Coffee Beige (157), Dark Brown (131), Granite Gray (191), Granite Green (192), Black (110).

**6" Casters:** All swivel, 2 with brake.

**Maximum load capacity:** 500 lbs.

Vinyl cover included. Not NSF listed.



TC1418

CODE	DESCRIPTION	EXTERIOR DIMENSIONS L x W x H	MAXIMUM TRAY SIZE	TRAY CAPACITY
TC1418	Cart with pans	32 3/8" x 21 1/4" x 45 1/2"	14" x 18"	180-200 in two stacks

Case Pack: 1

**Submittal Sheet**

01/09/2023

**ITEM# 19 - STORAGE/DRYING CART (1 EA REQ'D)**

Dinex DX1173X100

TMP® Drying & Storage Cart, holds 100 domes or 200 bases/underliners or Quicktemp® bases, 1" stainless steel tubing frame, 5" casters (2 with brakes) (1173/X100)

**ACCESSORIES**

Mfr	Qty	Model	Spec
Dinex	1		1 year parts & labor warranty

## DRYING AND STORAGE CARTS

### Item Numbers

- DX1173X50
- DX1173X80
- DX1173X100

### Cradle Inserts

- DX1173XC10



Item Number: DX1173XC10

Item Numbers: DX1173X50 & DX1173X100

### Application

The Drying and Storage Carts come fully assembled and ready to use. The frame is constructed of 1" tubular stainless steel for light weight and maximum strength. Cradle supports are 14 gauge welded and polished stainless steel. Cradles are uncoated stainless steel, and will not chip, split or corrode.

### Construction

**Frame:** 16-gauge stainless steel upright frame, 1" diameter

**Cradle Support:** 14-gauge stainless steel angle bars and 1" stainless steel center supports to hold removable cradle inserts (shipped with cart)

**Casters:** Four-5" swivel casters: Two have locking brakes

### Features

- Industrial-strength swivel-stem casters provide easy maneuverability. Locking wheels on 2 casters will secure cart in place.
- Carts feature a unique cradle design for easy loading, efficient drying and storage.
- Cradles are removable for easier ware washing in dish machine.
- Dry and store combinations for domes, insul-bases and underliners on the same cart for convenient storage, transport and tray make-up.
- Three sizes are available to meet your space requirements and storage needs.

### Warranty

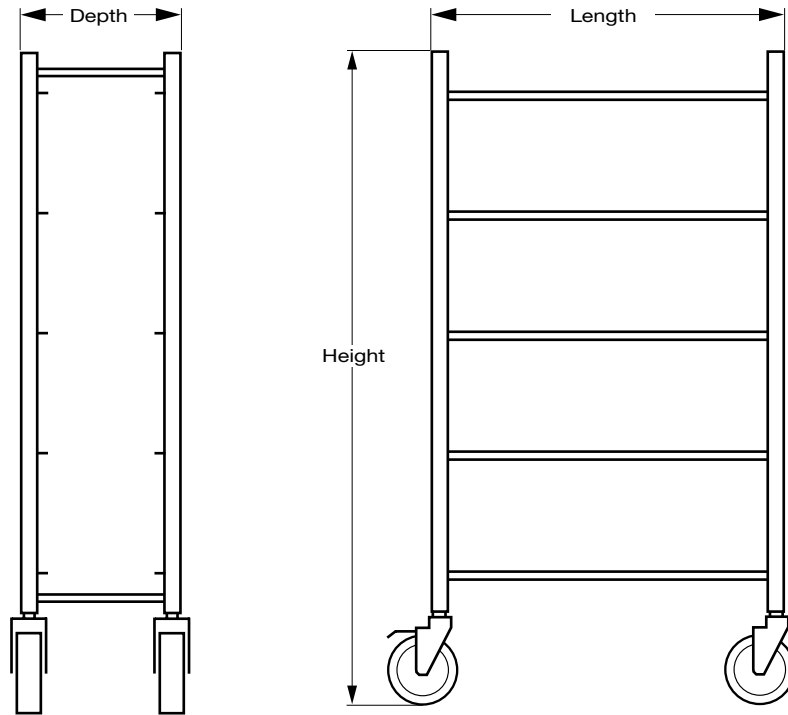
One year parts and labor.

# DINEX®

Building 2, Suite 106  
628 Hebron Avenue  
Glastonbury, CT 06033  
800.523.9752 Fax: 860.652.3135  
www.dinex.com

TMP-011-REV 10/09

# DRYING AND STORAGE CARTS

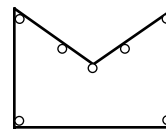


## Items and Dimensions

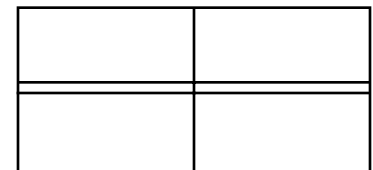
ITEM NUMBER	MODEL NUMBER	LENGTH	DEPTH	HEIGHT	WITH CRADLE	SHIP WEIGHT	SHIP CUBE	CRADLE SPACING	SHELF SPACING	NUMBER OF CRADLES	DOMES/ UNDERLINERS PER CRADLE	TOTAL CAP. DOMES/ UNDERLINERS
DX1173X50	1173/X50	19.5" (50cm)	20.25" (51cm)	73" (185cm)	79" (201cm)	115 lb. (52.2kg)	19.2	3.5" (9cm)	13" (33cm)	5	10/20	50/100
DX1173X80	1173/x80	40" (102cm)	20.25" (51cm)	59" (150cm)	65" (165cm)	125 lb. (56.8kg)	29.9	3.5" (9cm)	13" (33cm)	8	10/20	80/160
DX1173X100	1173/x100	40" (102cm)	20.25" (51cm)	73" (185cm)	19" (201cm)	145 lb. (65.8kg)	36.3	3.5" (9cm)	13" (33cm)	10	10/20	100/200

### Cradle Insert

Item Number	Model Number	Length	Depth	Height
DX1173XC10	1173/XC10	18"	17.5"	10.5"



Front View



Side View

Stainless steel cradle insert 14-gauge (uncoated) stainless steel



Please confirm that you have the most current specification sheet by visiting [www.dinex.com](http://www.dinex.com).  
 Dinex® reserves the right to change specifications and product design without notice.  
 Such revisions do not entitle the buyer to corresponding changes, improvements, additions or replacements for previously purchased equipment.

Printed in USA



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TMP-011-REV 10/09

# RACKS

## Drying & Storage Racks

- Versatile mobile racks for domes and bases **accommodate every foodservice need**
- Drying and Storage Racks keep your trayline and dishwashing area organized and operating at peak efficiency
- The stainless steel cradles are removable for easy cleaning in the dishwasher
- Induction Base Drying Racks are designed to efficiently dry, store and transport your Induction Bases
- DX1173XC10 Drying Cradle Insert is an easy carry cradle, made entirely of stainless steel; holds domes and bases securely for easier washing, drying and storage
- Some units are NSF Listed, see product chart for details
- Locking casters allow for safe and easy staging of your trayline
- The tray drying rack allows for ample ventilation for drying and storage of trays



DX1173X50



DX1173X100



DXIBDRS90



DX10053



DX1173XC10



DXIDTDR3

Prod No	Description	L x D x H	Pack
<b>Stainless Steel Storage Racks For 9" Domes &amp; Underliners</b>			
DX1173X50 <span style="color: teal;">▲</span>	Holds 50 domes or 100 bases/underliners	19.5" x 20.25" x 73" / 49.5 x 51.4 x 185.4 cm	1 ea
DX1173X80 <span style="color: teal;">▲</span>	Holds 80 domes or 160 bases/underliners	40" x 20.25" x 59" / 101.5 x 51.4 x 149.8 cm	1 ea
DX1173X100 <span style="color: teal;">▲</span>	Holds 100 domes or 200 bases/underliners	40" x 20.25" x 73" / 101.5 x 51.4 x 185.4 cm	1 ea
DX1173XC10	Replacement Drying Cradle Insert for DX1173 Series	18" x 17.5" x 10.5" / 45.7 x 44.4 x 26.7 cm	1 ea
<b>Storage Racks For Induction Bases</b>			
DXIBDRS90 <span style="color: teal;">▲</span>	Holds 90 Induction Bases	20.5" x 22" x 78" / 52.1 x 55.9 x 198.1 cm	1 ea
DXIBDRS180 <span style="color: teal;">▲</span>	Holds 180 Induction Bases	40" x 22" x 78" / 101.6 x 55.9 x 198.1 cm	1 ea
DXIBDRS270 <span style="color: teal;">▲</span>	Holds 270 Induction Bases	59.5" x 22" x 78" / 151.1 x 55.9 x 198.1 cm	1 ea
DX10251DT	Replacement Wire Cradle (18 bases per cradle)	17.75" x 18" x 6" / 45.1 x 45.7 x 15.2 cm	1 ea
<b>Stainless Steel Storage Racks For 9" Domes &amp; Underliners</b>			
DXIRDSD950 <span style="color: teal;">▲</span>	Holds 50 domes or 100 bases/underliners	22.5" x 22" x 78" / 57.1 x 55.8 x 198.1 cm	1 ea
DXIRDSD9100 <span style="color: teal;">▲</span>	Holds 100 domes or 200 bases/underliners	44" x 22" x 78" / 111.7 x 55.8 x 198.1 cm	1 ea
DXIRDSD9150 <span style="color: teal;">▲</span>	Holds 150 domes or 300 bases/underliners	65.5" x 22" x 78" / 166.2 x 55.8 x 198.1 cm	1 ea
DX10053	Washrack & Cradle for 9" Domes (fits D950, D9100, D9150)	19" x 18.25" x 7.5" / 48.7 x 46.36 x 19 cm	2 ea
<b>Flat Tray Drying Racks</b>			
DXIDTDR3	Drying rack for 14"x 18" & 15"x 20" flat trays (approx 120 trays)	63.75" x 28" x 74.5" / 161.8 x 71.1 x 189.2cm	1 ea

Dinex by CFS Brands NSF Listed products are designated with a ▲ and may be prefixed with an N



## Submittal Sheet

01/09/2023

### ITEM# 20 - ICE MAKER, CUBE-STYLE (1 EA REQ'D)

Manitowoc IDT0450A

Indigo NXT™ Series Ice Maker, cube-style, air-cooled, self-contained condenser, 30"W x 24"D x 21-1/2"H, production capacity up to 470 lb./24 hours at 70°/50° (358 lb. AHRI certified tat 90°/70°), easyTouch display with 13 different language options, date/time stamp display, automatic reminder/alert icon, one touch asset information, automatic detection of accessories, continuous operating status, programmable production options (time, weight, day or night), one touch cleaning with displayed instructions, Alpha-San anti-microbial protection, acoustical ice sensing probe, self-diagnostic technology, DuraTech™ exterior, dice size cubes, R410A refrigerant, NSF, cULus, CE, ENERGY STAR® \*\*(An additional 5% Manufacture's surcharge will be added to list price between 11/8/21 to 1/2/22)\*\*

### ACCESSORIES

Mfr	Qty	Model	Spec
Manitowoc	1	WARRANTY-ICE-SC	3 year parts & labor (Machine), 5 year parts & labor (Evaporator), 5 year parts & 3 years labor (Compressor), standard (nc) **(An additional 5% Manufacture's surcharge will be added to list price between 11/8/21 to 1/2/22)**
Manitowoc	1		(-161) 115v/60/1-ph, 11.9 amps
Manitowoc	1	D570	Ice Bin, 30"W x 34"D x 50"H, with side-hinged front-opening door, side grips, 532 lbs. application capacity, AHRI certified 17.9 cu. ft., for top-mounted ice maker, Duratech exterior, NSF ** (An additional 5% Manufacture's surcharge will be added to list price between 11/8/21 to 1/2/22)**
Manitowoc	1	WARRANTY-BIN/DISP	3 year parts & labor warranty, standard (nc) **(An additional 5% Manufacture's surcharge will be added to list price between 11/8/21 to 1/2/22)**
Manitowoc	1		Legs, 6" adjustable stainless steel, standard

### ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	115	60	1				11.9				

### WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1				3/8"					
2									

### WASTE

	INDIRECT SIZE	DIRECT SIZE
1	1/2"	
2	3/4"	

### PLUMBING 1 REMARKS

Drain for ice maker




**INDIGO<sup>®</sup> NXT**

50Hz

# iT0450 Ice Cube Machine

 Indigo<sup>®</sup> NXT™ iT0450 Ice Cube Machine

## Models

 IDT0450A     IYT0450A     IDT0450W

 Indigo NXT Series iT0450  
Ice Machine on D400 Bin

Designed for operators who know that ice is critical to their business, the Indigo NXT Series ice machine's preventative diagnostics continually monitor itself for reliable ice production. Improvements in cleanability and programmability make your ice machine easy to own and less expensive to operate.

- **New levels of Performance** – Showcasing an average of 9% lower energy consumption, up to 12% increase in ice production and a 19% reduction in condenser water usage and a 5% reduction in potable water usage. . This translates into lower cost of ownership over the life of your machine.
- **easyTouch<sup>®</sup> Display** – New icon based touch screen takes the guess work out of owning and operating an ice machine.
- **Multiple Language Capability** – The easyTouch display is available in multiple languages selected in the initial start-up installation Wizard.
- **Programmable Ice Production** – Now its super easy to program your ice machine to be off at certain times of the day to save money with fluctuating electrical rates. Also programmable by daily ice production volume.
- **Easy to Clean Foodzone** – Hinge front door swing out for easy access. Removable water-trough, distribution tube, curtain, water probe and water pump for fast and efficient cleaning. Selected components are made with AlphaSan<sup>®</sup> antimicrobial.
- **Intelligent Diagnostics** – Provides 24 hour preventative maintenance and diagnostic feedback for trouble free operation.
- **Acoustical Ice Sensing Probe** – Unique patented technology allows for reliable operation in challenging water conditions and environments
- Available **LuminIce<sup>®</sup> II Growth Inhibitor** – Controls the growth of bacteria and yeast within the Food zone keeping the machine cleaner longer. A new indicator in the display keeps you abreast of the operational status.

## Ice Machine Electric

230/ 50/ 1

### Minimum circuit ampacity:

 Air-cooled: 5.6 amps  
 Water-cooled: 5.3 amps

### Maximum fuse size:

 Air Cooled: 15 amps  
 Water cooled 15 amps

## Specifications

### BTU Per Hour:

 3,800 (average),  
 and 6,000 (peak)

### Refrigerant:

 R410A CFS - Free  
 Lowers global warming  
 by 48%

### Operating Limits:

- Ambient Temperature Range: 40° to 110° F (4.4° to 43.3° C)  
 Water Temperature Range: 40° to 90° F (4.4° to 32.2° C)
- Water Pressure Ice Maker Water In:  
 Min. 20 psi (137.9 kPa)  
 Max. 80 psi (551.1 kPa)
- Condenser Water Pressure:  
 Min. 20 psi (137.9 kPa)  
 Max. 276 psi (1902.95 kPa)

## Ice Shape



**Half Dice**  
 $\frac{3}{8}$ " x  $1\frac{1}{8}$ " x  $\frac{7}{8}$ "  
 (.95 x 2.86 x 2.22 cm)  
 Cube weight 5.7 g



**Dice**  
 $\frac{7}{8}$ " x  $\frac{7}{8}$ " x  $\frac{7}{8}$ "  
 (2.22 x 2.22 x 2.22 cm)  
 Cube weight 8.5 g



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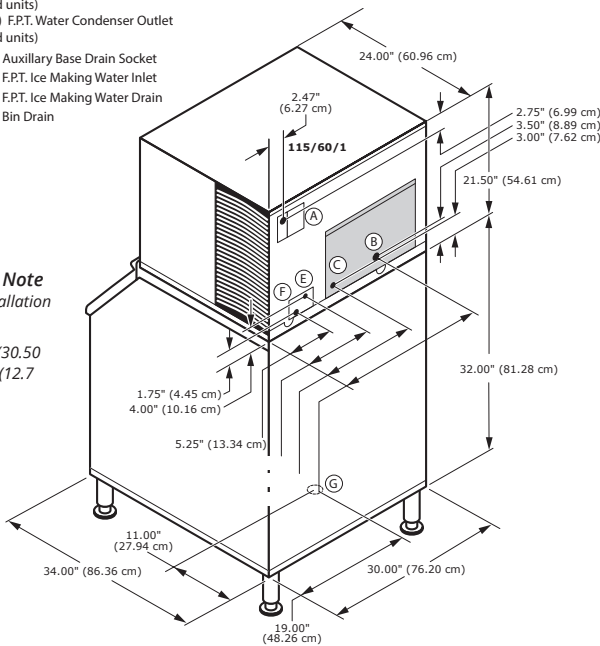


# 50Hz

Indigo® NXT™ iT0450 Ice Cube Machine

## iT0450 on D-400 Storage Bin

- Ⓐ Electrical Entrance (2) Options
- Ⓑ 3/8" (0.95 cm) F.P.T. Water Condenser Inlet (water-cooled units)
- Ⓒ 1/2" (1.27 cm) F.P.T. Water Condenser Outlet (water-cooled units)
- Ⓓ 1/2" (1.27 cm) Auxillary Base Drain Socket
- Ⓔ 3/8" (0.95 cm) F.P.T. Ice Making Water Inlet
- Ⓕ 1/2" (1.27 cm) F.P.T. Ice Making Water Drain
- Ⓖ 3/4" (1.91 cm) Bin Drain



**Installation Note**  
Minimum installation clearance:  
Top/side: 12" (30.50 cm)  
Back is 5" (12.7 cm)

## Space-Saving Design



	iT0450 D-400	iT0450 D-570
Height	59.50"	71.50"
	151.13 cm	181.61 cm
Width	30.00"	30.00"
	76.2 cm	76.2 cm
Depth	34.00"	34.00"
	86.30 cm	86.30 cm
Bin	365 lbs.	543 lbs.
Storage	165.7 kgs.	241.1 kgs.

Height includes adjustable bin legs 6.00" to 8.00", (15.24 to 20.32 cm) set at 6.00" (15.24 cm).  
Bin capacity is based on 90% of the volume x 33 lbs/ft<sup>3</sup> average density of ice.

## Specifications

	Model	Ice Shape	Ice Production 24 Hours		Power Usage kWh 45.4 kg / 100 lbs @ 32°Air / 21°C Water 90°Air / 70°F Water	Potable Water Usage/100 lbs. 45.4 kgs. of Ice
			21°Air / 10°C Water 70°Air / 50°F Water	32°Air / 21°C Water 90°Air / 70°F Water		
<b>AIR COOLED</b>	IDT0450A	dice	440 lbs.	355 lbs.	1 Ph	19 Gal.
			200 kgs	161 kgs		
<b>AIR COOLED</b>	IYT0450A	half-dice	460 lbs.	375 lbs.	5.30	19 Gal.
			209 kgs	170 kgs		
<b>WATER COOLED</b>	IDT0450W	dice	420 lbs.	355 lbs.	4.88	19 Gal.
			191 kgs	161 kgs		

\* Water-cooled Condenser Water Usage / 100 lbs. /45.4 kgs. Of Ice: 140 gal/ 530 L.

Order separately: Ice storage bin for all units  
This product is hermetically sealed and contains fluorinated greenhouse gas R410A

## Accessories

**LuminIce® II Growth Inhibitor**  
reduces yeast and bacteria growth for a cleaner ice machine.



**External Scoop holder**  
Protect the ice scoop with the NSF approved versatile scoop holder.



**Arctic Pure® Plus Water Filters**  
reduce sediments and chlorine contaminants down to .5 microns. Use with a Pre-filter is recommended.



Welbilt reserves the right to make changes to the design or specifications without prior notice.

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6645A\_50Hz\_10/2021





## **ICE MACHINE WARRANTY**

Manitowoc Ice, Inc. (hereinafter referred to as the "COMPANY") warrants for a period of thirty-six months from the installation date (except as limited below) that new ice machines manufactured by the COMPANY shall be free of defects in material or workmanship under normal and proper use and maintenance as specified by the COMPANY and upon proper installation and start-up in accordance with the instruction manual supplied with the ice machine. The COMPANY'S warranty hereunder with respect to the compressor shall apply for an additional twenty-four months, excluding all labor charges, and with respect to the evaporator for an additional twenty-four months, including labor charges.

The obligation of the COMPANY under this warranty is limited to the repair or replacement of parts, components, or assemblies that in the opinion of the COMPANY are defective. This warranty is further limited to the cost of parts, components or assemblies and standard straight time labor charges at the servicing location.

Time and hourly rate schedules, as published from time to time by the COMPANY, apply to all service procedures. Additional expenses including without limitation, travel time, overtime premium, material cost, accessing or removal of the ice machine, or shipping are the responsibility of the owner, along with all maintenance, adjustments, cleaning, and ice purchases. Labor covered under this warranty must be performed by a COMPANY Contracted Service Representative or a refrigeration service agency as qualified and authorized by the COMPANY'S local Distributor. The COMPANY'S liability under this warranty shall in no event be greater than the actual purchase price paid by customer for the ice machine.

The foregoing warranty shall not apply to (1) any part or assembly that has been altered, modified, or changed; (2) any part or assembly that has been subjected to misuse, abuse, neglect, or accidents; (3) any ice machine that has been installed and/or maintained inconsistent with the technical instructions provided by the COMPANY; or (4) any ice machine initially installed more than five years from the serial number production date. This warranty shall not apply if the Ice Machine's refrigeration system is modified with a condenser, heat reclaim device, or parts and assemblies other than those manufactured by the COMPANY, unless the COMPANY approves these modifications for specific locations in writing.

**THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES OR GUARANTEES OF ANY KIND, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

In no event shall the COMPANY be liable for any special, indirect, incidental or consequential damages. Upon the expiration of the warranty period, the COMPANY'S liability under this warranty shall terminate.

The foregoing warranty shall constitute the sole liability of the COMPANY and the exclusive remedy of the customer or user. To secure prompt and continuing warranty service, the warranty registration card or register on line within five (5) days from the installation date.

### **MANITOWOC ICE, INC.**

2110 So. 26th St., P.O. Box 1720, Manitowoc, WI 54221-1720

Telephone: 920-682-0161 • Fax: 920-683-7585

Web Site - [www.manitowocice.com](http://www.manitowocice.com)

Form 80-0373-3 Rev. 01/02



Ice Storage Bins

# Ice Storage Bins

## Model

- D320  
  D400  
  D420  
  D570  
  D970

### D Bins

.75" (1.90 cm) Bin drain



D320  
264 lbs. (120 kgs)



D570  
532 lbs. (241 kgs)



D400  
365 lbs. (166 kgs)



D970  
882 lbs (400 kgs)



D420  
383 lbs. (174 kgs)



Ergonomic NSF approved sanitary ice scoop included

### D Bin Features

**New Sanitary Scoop** Ergonomic NSF approved sanitary ice scoop included with each bin. Built-in knuckle and thumb guard. Unique molded retaining lip allows maximum scooping every time. Per scoop capacity approximately 5.3/ lbs (2.4 kg)

**Scoop Holder options** New built-in scoop holder, keeps the ice scoop handle above the ice, or purchases the optional NSF approved External Scoop Holder Kit # K00461.

**New Door design** Clever built in side grips allow you to lift the bin door from anywhere you are standing (left, right or center) even when you have just one hand free.

### Foamed Insulated Door

Insulates the ice bin, reduces sweat on the door, helps keep ice lasting longer.

**Stay up door** Unique cammed bin door self-latch keeps the door in the open position and keeps the employee safe when scooping ice.

**Ergonomic Door design** Door is angled 53 degrees to allow for easier access to the ice in the bin especially when scooping from the bottom.

**Duratech Metal Finish** Manitowoc exterior material has better corrosion resistance than stainless steel, is smudge resistant and easy to keep clean.

**New Bin liner** Polyurethane Artic Blue bin liner accentuates the crisp clear ice from a Manitowoc Ice Machine.

### Warranty

Bin & Accessories: 3 Year Parts & Labor.

D Bin Model	D-Bin Capacities				D-Bin Dimensions					
	*Application Capacity		**2018 AHRI Capacity		Height		Width		Depth	
	lbs.	kgs	Cu. ft	Cu. M	in.	cm	in.	cm	in.	cm
D320	264	119.90	8.9	0.25	38	96.5	22	55.9	34	86.4
D420	383	173.79	12.9	0.37	50	127	22	55.9	34	86.4
D400	365	165.70	12.3	0.35	38	96.5	30	76.2	34	86.4
D570	532	241.14	17.9	0.51	50	127	30	76.2	34	86.4
D970	882	400.11	29.7	0.84	50	127	48	121.9	34	86.4

\*Application Capacity based on 90% of the total volume x 33 lbs/ ft<sup>3</sup> average density of ice. Ice must be managed  
 \*\*2018 AHRI certified measurement for bin capacity

Above bin heights include leg height of of 6" / 15.24 cm  
 All bins include a sanitary plastic scoop and one set of adjustable legs chrome legs (6-7.75in/15.24-20.32cm).  
 External Scoop holder order separately Kit # K00461  
 Metal Scoop order separately Kit # K00463



Welbilt reserves the right to make changes to the design or specifications without prior notice.

2110 South 26th Street  
Manitowoc, WI 54220

Tel: 1.920.682.0161  
Fax: 1.920.683.7589

www.manitowocice.com  
6453D  
09/2021





D Bins

Indigo Ice Machines Series												
Machine			iT420	iT620	iT0300	iT450	iT0500 & iF0500N	iF0600N, iF0600C, iT0750	iF0900N, iT0900, iF0900C	iT1200, iT1200C	iF1400C, iF1800C	iT1500, iT1900
Machine Capacity @90/70 F			375	465	240	378	440	555, 530	710, 714	950, 1000	1200 1470 1600	1360, 1455
Bins	Bin Cap	Width	22"	22"	30"	30"	30"	30"	30"	30"	30"	48"
D320	264	22"	*	*								
D420	383	22"	*	*								
D400	365	30"	K00472	K00472	*	*	*	*	NR	NR	NR	
D570	532	30"	K00472	K00472	*	*	*	*	*	*	NR	
D970	882	48"	NR	NR	NR	K00470	K00470	K00470	K00470	K00470	K00471 + K00470	*

Manitowoc Flaker and Nugget Machines											
Machine			RNP0320	RFP0320	RNP0620	RFP0620	RNF1020	RFF1220C	RNF1100	RFF1300 & RNF2000C	RFF2200C
Machine cap			251	286	451	540	825	958	825	874	1702
Bins	Bin cap	Width	22"	22"	22"	22"	22"	22"	30"	30"	36.7"
D320	264	22"	*	*	NR	NR	NR	NR			
D420	383	22"	*	*	*	*	NR	NR			
D400	365	30"	K00472	K00472	K00472	K00472	NR	NR	NR	NR	
D570	532	30"	NR	K00472	K00472	K00472	NR	NR	*	*	
D970	882	48"	NR	NR	K00473	K00473	K00473 if 2 used.	K00473 if 2 used.	K00470	K00470	K00470

An optional adapter is required when putting a narrower ice machine on a wider bin.  
 \* No adapter is needed  
 NR= Not Recommend. Bin too small or too large for application.  
 Putting a wider machine on narrower bin is not an option.  
 Machines side by side must be water cooled, remote, or use a top air discharge for self-contained air cooled.  
 Application Bin Capacity shown in lbs using the AHRI rating based on 90% of total volume x 33 lbs/ft<sup>3</sup> average density of ice.  
 Machine capacity shown in lbs/24hrs using the AHRI rating base at 90F ambient, 70F water temperature

Ice Storage Bins

Available Accessories See price book for replacement: scoops, legs, specialty legs and casters

**K00146 Convenient Ice Bagger**

Includes bagger, D-bin adapter, and 250 bags and ties (Not for D320 or D400) Order K00068 replacement bags



**K00461 External Scoop Holder**

NSF approved. Can be mounted on the left or right side of bins, horizontally or vertically or on a wall.



**K00463 Metal Scoop**

Indestructible NFS approved aluminum alloy with sanitary knuckle and thumb guard. Works with K00461 external scoop holder or hangs inside the D-Bin series. Limited life time guarantee.



**K00462 Secure Fastening Kit**

Securely fast the Indigo NXT ice machine head to the pre-drilled inserts on the back of the D-bin series. Stainless steel flanged feet attach to bin and can be screwed to the floor



Welbilt reserves the right to make changes to the design or specifications without prior notice.

2110 South 26th Street  
 Manitowoc, WI 54220

Tel: 1.920.682.0161  
 Fax: 1.920.683.7589

www.manitowocice.com  
 6453D  
 09/2021







## LIMITED WARRANTY FOR ICE STORAGE BIN & DISPENSERS

### LIMITED WARRANTY

Manitowoc Ice a division of Manitowoc FSG Operations, LLC, ("Company") warrants that new Ice Storage Bins or Dispensers sold by Company shall be free of defects in material or workmanship under normal and proper use and maintenance as specified by the Company and upon proper installation and start-up in accordance with the instruction manual supplied.

### WHAT IS COVERED

- Parts and Labor for a period of three (3) years.
  - Accessory Ice Transport Carts for two (2) years parts and labor.
- The Ice Storage Bin / Dispenser warranty begins on the date of the original installation. This warranty shall not apply to any Ice Storage Bin or Dispenser initially installed more than five (5) years from the serial number production date.

The obligation of the Company under this warranty is limited to the repair or replacement of parts, components, or assemblies that in the sole opinion of the Company are defective. This warranty is further limited to the cost of parts, components or assemblies and standard straight time labor charges at the servicing location.

Time and hourly rate schedules, as published from time to time by the Company, apply to all service procedures. Additional expenses including without limitation, travel time, overtime premium, material cost, accessing or removal of the Ice Storage Bin / Dispenser, or shipping are the responsibility of the purchaser, along with all maintenance, adjustments, cleaning, and ice purchases. Labor covered under this warranty must be performed by an approved Company contracted Service Representative or a refrigeration service agency as qualified and authorized by the Company's local Distributor. The Company's liability under this warranty shall in no event be greater than the actual purchase price paid by purchaser for the Ice Storage Bin or Dispenser.

### EXCLUSIONS FROM COVERAGE

- Repair or replacement of parts required because of misuse, improper care or storage, negligence, alteration, use of incompatible supplies or lack of specified maintenance shall be excluded.
- Normal maintenance items.
- Failures caused by adverse environmental, water conditions, or improper drainage.
- Improper or unauthorized repair.
- Any Ice Storage Bin / Dispenser that has been installed and/or maintained inconsistent with the instructions provided by the Company.
- Parts subject to damage beyond the control of Company, or to Ice Storage Bin's / Dispenser's which have been subject to accidents, damage in shipment, fire, floods, other hazards or acts of God that are beyond the control of the Company.
- This Limited Warranty shall not apply if the Ice Storage Bin / Dispenser is modified with parts and assemblies other than those manufactured by the Company, unless the Company approves these modifications for specific locations in writing prior to the commencement of such modification.

### LIMITATIONS OF LIABILITY

The preceding paragraphs set forth the exclusive remedy for all claims based on failure of, or defect in, Ice Storage Bins or Dispensers sold hereunder, whether the failure or defect arises before or during the warranty period, and whether a claim, however instituted, is based on contract, indemnity, warranty, tort (including negligence), strict liability, implied by statute, common-law or otherwise, and Company and agents shall not be liable for any claims for personal injuries or consequential damages or loss, howsoever caused. Upon the expiration of the warranty period, all such liability shall terminate. THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL, IMPLIED OR STATUTORY NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE SHALL APPLY, COMPANY DOES NOT WARRANT ANY PRODUCTS OR SERVICES OF OTHERS

### REMEDIES

The liability of Company for breach of any warranty obligation hereunder is limited to: (i) the repair or replacement of the Ice Storage Bin or Dispenser on which the liability is based, or with respect to services, re-performance of the services; or (ii) at Company's option, the refund of the amount paid for said equipment or services. Any breach by Company with respect to any item or unit of equipment or services shall be deemed a breach with respect to that item or unit or service only

### WARRANTY CLAIM PROCEDURE

Customer shall be responsible to:

- Complete and return warranty registration card or register on line within five (5) days from the installation date.
- All warranty service must be performed by an approved Manitowoc contracted or authorized Service Representative. To schedule a service appointment contact your local Manitowoc Service Representative or visit us at [www.manitowocice.com](http://www.manitowocice.com) to find a Service Representative near you.

### GOVERNING LAW

This Limited Warranty shall be governed by the laws of the state of Wisconsin, USA, excluding their conflicts of law principles. The United Nations Convention on Contracts for the International Sale of Goods is hereby excluded in its entirety from application to this Limited Warranty

### COMPLETE AND RETAIN FOR YOUR RECORD:

Distributor/Dealer \_\_\_\_\_

Model Number \_\_\_\_\_

Serial Number \_\_\_\_\_

Installation Date \_\_\_\_\_

Manitowoc Ice  
2110 South 26th Street  
P.O. Box 1720  
Manitowoc, WI 54221-1720  
Web site: [www.manitowocice.com](http://www.manitowocice.com)



**Submittal Sheet**

01/09/2023

**ITEM# 21 - WATER FILTRATION SYSTEM, FOR ICE MACHINES (1 EA REQ'D)**

Everpure EV932401

Insurice® Single-i2000<sup>2</sup> System, 9,000 gallon capacity, 1.67 gpm flow rate, 0.5-micron filtration, for cubers up to 500 lbs/day or flakers up to 1,500 lbs/day, pressure gauge, flushing valve, NSF, ANSI

**WATER**

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1				3/8"					

**WASTE**

	INDIRECT SIZE	DIRECT SIZE
1		



# EVERPURE® INSURICE® SINGLE - i2000<sup>2</sup> SYSTEM

DELIVERS PREMIUM QUALITY WATER FOR ICE APPLICATIONS

Insurice Single - i2000<sup>2</sup> System: EV9324-01  
i2000<sup>2</sup> Replacement Cartridge: EV9612-22



## APPLICATIONS

Ice Machines

- Cubers 500 lbs/day
- Flakers 1,500 lbs/day
- Capacity: 9,000 gals

## FEATURES • BENEFITS

Reduces water-related ice machine problems caused by scale buildup from dirt and dissolved minerals

Sanitary cartridge replacement is simple, quick and clean. Internal filter parts are never exposed to handling or contamination

Reduces maintenance and service costs by reducing scale and clogging of distribution lines, evaporator plate and pump

Exclusive precoat filtration provides superior chlorine taste & odor reduction and micro-filters dirt and particles as small as 0.5 micron in size by mechanical means

Proprietary Micro-Pure® II filtration media effectively inhibits the growth of bacteria on the filter media that can decrease product life

Reduces chlorine taste & odor and other offensive contaminants

Self-contained scale inhibitor feed keeps ice machines functioning at full capacity

NSF/ANSI Standard 53 certified to reduce cysts such as *Cryptosporidium* and *Giardia* by mechanical means

## INSTALLATION TIPS

Choose a mounting location suitable to support the full weight of the system when operating.

Never use saddle valve for connection.

Use 3/8" water line.

Do not connect system to water-cooled condenser.

Install vertically with cartridges hanging down and allow 2½" (6.35 cm) clearance below the cartridge for easy cartridge replacement.

Flush cartridges by running water through system for five (5) minutes at full flow.

## OPERATION TIPS

Change cartridges on a regular six (6) month preventative maintenance program.

Change cartridges when capacity is reached or when flow becomes too slow.

Service flow rate must not exceed 1.67 gpm (6.3 Lpm).

Always flush the filter cartridge at time of installation and cartridge change.

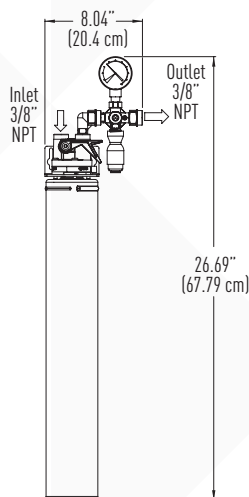
## SIZING

Service Flow Rate: Maximum 1.67 gpm (6.3 Lpm)

**FOODSERVICE** | [EV9324-01 SPECIFICATION SHEET](#)

# EVERPURE® INSURICE® SINGLE - i2000<sup>2</sup> SYSTEM

## EV9324-01



### SPECIFICATIONS

#### Service Flow Rate

Maximum 1.67 gpm (6.3 Lpm)

#### Pressure Requirements

10 – 125 psi (0.7 – 8.6 bar), non-shock

#### Temperature

35 – 100°F (2 – 38°C)

#### Overall Dimensions

26.69" H x 8.04" W x 5.25" D  
(67.79 cm x 20.4 cm x 13.3 cm)

#### Inlet Connection

3/8"

#### Outlet Connection

3/8"

#### Electrical Connection

None required

#### Shipping Weight

6 lbs (2.7 kgs)

#### Operating Weight

9 lbs (4 kgs)



System Tested and Certified by NSF International against NSF/ANSI Standards 42 and 53 for the reduction of:

STANDARD NO. 42 –  
AESTHETIC EFFECTS

Chemical Reduction  
Taste & Odor  
Chlorine

Mechanical Filtration  
Nominal Particulate Class I

STANDARD NO. 53 –  
HEALTH EFFECTS

Mechanical Filtration  
Cyst

EPA No. 002623-IL-002

The contaminants or other substances removed or reduced by this drinking water system are not necessarily in your water. Do not use with water that is microbiologically unsafe or of unknown quality without adequate disinfection before or after the system. Systems certified for cyst reduction may be used with disinfected water that may contain filterable cysts.

### WARRANTY

Everpure water treatment systems by Pentair® (excluding replaceable elements) are covered by a limited warranty against defects in material and workmanship for a period of five years after date of purchase. Everpure replaceable elements (filter cartridges and water treatment cartridges) are covered by a limited warranty against defects in material and workmanship for a period of one year after date of purchase. See printed warranty for details. Pentair will provide a copy of the warranty upon request.



#### WATER QUALITY SYSTEMS

EVERPURE-SHURFLO WORLD HEADQUARTERS, 1040 MUIRFIELD DRIVE, HANOVER PARK, IL 60133 USA • FOODSERVICE.PENTAIR.COM  
800.942.1153 (US ONLY) • 630.307.3000 MAIN • 630.307.3030 FAX • CSEVERPURE@PENTAIR.COM EMAIL

EVERPURE-SHURFLO AUSTRALIA, 1-21 MONASH DRIVE, DANDENONG SOUTH, VIC 3175 AUSTRALIA  
011.1300 576 190 TEL • 011.61.39.562.7237 FAX • AU.EVERPURE@PENTAIR.COM EMAIL

EVERPURE-SHURFLO CHINA, 21F CLOUD 9 PLAZA, NO 1118, SHANGHAI, 200052, CHINA  
86.21.3211.4588 TEL • 86.21.3211.4580 FAX • CHINA.WATER@PENTAIR.COM EMAIL

EVERPURE-SHURFLO INDIA, GREEN BOULEVARD, B-9/A, 7TH FLOOR - TOWER B SECTOR 62, NOIDA - 201301  
91.120.419.9444 TEL • 91.120.419.9400 FAX • INDIACUSTOMER@PENTAIR.COM EMAIL

EVERPURE-SHURFLO EUROPE, PENTAIR WATER BELGIUM BVBA, INDUSTRIEPARK WOLFSTEE, TOEKOMSTLAAN 30, B-2200 HERENTALS, BELGIUM  
+32.(0).14.283.504 TEL • +32.(0).14.283.505 FAX • SALES@EVERPURE-EUROPE.COM EMAIL

EVERPURE-SHURFLO JAPAN INC., HASHIMOTO MN BLDG. 7F, 3-25-1 HASHIMOTO, MIDORI-KU, SAGAMIHARA-SHI KANAGAWA 252-0143, JAPAN  
81.(0)42.775.3011 TEL • 81.(0)42.775.3015 FAX • INFO@EVERPURE.CO.JP EMAIL

EVERPURE-SHURFLO SOUTHEAST ASIA, 390 HAVELOCK ROAD, #04-01 KING'S CENTRE, SINGAPORE 169662  
65.6768.5800 TEL • 65.6737.5149 FAX • CSEVERPURE@PENTAIR.COM EMAIL

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## Submittal Sheet

01/09/2023

### ITEM# 22 - FLOOR TROUGH (1 EA REQ'D)

Eagle Group ASFT-1284-FG

Anti-Splash Floor Trough, 84"W x 12"D, yellow fiberglass subway-style grating with non-slip surface, 6" deep trough pan with built-in pitch toward drain, accommodates up to a 4" diameter drain pipe, stainless steel removable perforated basket, all-welded 14/304 stainless steel construction, NSF

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	1		ADA-compliant grating

#### WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1									

#### WASTE

	INDIRECT SIZE	DIRECT SIZE
1		4"





Profit from the Eagle Advantage®

## Specification Sheet

### Short Form Specifications

Eagle Anti-Splash Floor Trough with stainless steel grating, model \_\_\_\_\_. Unit constructed of 14/304 stainless steel all-welded construction. Patented anti-splash design (patent #D519,618 S) assures complete drainage while preventing splash back onto the floor. Drain accommodates up to a 4"-diameter pipe and comes standard with a stainless steel removable perforated basket. Type 304 stainless steel subway style grating shall be 5/8" x 1" vertically positioned bars spaced 1" apart for ease of drainage. Two 5/8" stainless steel rods, set 2 1/4" in from each edge, are welded to the bars to eliminate swaying.

Eagle Anti-Splash Floor Trough with fiberglass grating, model \_\_\_\_\_. Unit constructed of 14/304 stainless steel all-welded construction. Patented anti-splash design (patent #D519,618 S) assures complete drainage while preventing splash back onto the floor. Drain accommodates up to a 4"-diameter pipe and comes standard with a stainless steel removable perforated basket. Fiberglass grating to be 1" high yellow polyester material with a non-slip grit surface. Tapered "I" beam construction for ease of cleaning and drainage. Gray color grating available.



anti-splash floor trough

### Options / Accessories

- Gray color fiberglass grating
- ADA-compliant wide "T" Bar fiberglass grating, gray color

### EAGLE GROUP

100 Industrial Boulevard, Clayton, DE 19938-8903 USA

Phone: 302-653-3000 • Fax: 302-653-2065

www.eaglegrp.com

Foodservice Division: Phone 800-441-8440

MHC/Retail Display Divisions: Phone 800-637-5100

For custom configuration or fabrication needs, contact our **SpecFAB®** Division.

Phone: 302-653-3000 • Fax: 302-653-3091 • e-mail: specfab@eaglegrp.com

**Spec sheets available for viewing, printing or downloading from our online literature library at [www.eaglegrp.com](http://www.eaglegrp.com)**

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Item No.: \_\_\_\_\_  
Project No.: \_\_\_\_\_  
S.I.S. No.: \_\_\_\_\_

## Anti-splash Floor Troughs

### MODELS:

- |                                       |                                       |                                       |
|---------------------------------------|---------------------------------------|---------------------------------------|
| <input type="checkbox"/> ASFT-1218-*  | <input type="checkbox"/> ASFT-1548-*  | <input type="checkbox"/> ASFT-1884-*  |
| <input type="checkbox"/> ASFT-1224-*  | <input type="checkbox"/> ASFT-1560-*  | <input type="checkbox"/> ASFT-1896-*  |
| <input type="checkbox"/> ASFT-1230-*  | <input type="checkbox"/> ASFT-1572-*  | <input type="checkbox"/> ASFT-18120-* |
| <input type="checkbox"/> ASFT-1236-*  | <input type="checkbox"/> ASFT-1584-*  | <input type="checkbox"/> ASFT-2424-*  |
| <input type="checkbox"/> ASFT-1248-*  | <input type="checkbox"/> ASFT-1596-*  | <input type="checkbox"/> ASFT-2430-*  |
| <input type="checkbox"/> ASFT-1260-*  | <input type="checkbox"/> ASFT-15120-* | <input type="checkbox"/> ASFT-2436-*  |
| <input type="checkbox"/> ASFT-1272-*  | <input type="checkbox"/> ASFT-1824-*  | <input type="checkbox"/> ASFT-2448-*  |
| <input type="checkbox"/> ASFT-1284-*  | <input type="checkbox"/> ASFT-1830-*  | <input type="checkbox"/> ASFT-2460-*  |
| <input type="checkbox"/> ASFT-1296-*  | <input type="checkbox"/> ASFT-1836-*  | <input type="checkbox"/> ASFT-2472-*  |
| <input type="checkbox"/> ASFT-12120-* | <input type="checkbox"/> ASFT-1848-*  | <input type="checkbox"/> ASFT-2484-*  |
| <input type="checkbox"/> ASFT-1524-*  | <input type="checkbox"/> ASFT-1860-*  | <input type="checkbox"/> ASFT-2496-*  |
| <input type="checkbox"/> ASFT-1530-*  | <input type="checkbox"/> ASFT-1872-*  | <input type="checkbox"/> ASFT-24120-* |
| <input type="checkbox"/> ASFT-1536-*  |                                       |                                       |

\* See chart on back for complete model numbers.

### Design and Construction Features

- Patented "anti-splash" design (patent #D519,618 S) assures complete drainage, while preventing splash back onto floor.
- 14 gauge type 304 stainless steel all-welded construction.
- Built-in pitch towards drain insures complete drainage.
- Stainless steel drain accommodates up to a 4" (102mm) diameter pipe, and features a removable perforated stainless steel basket.
- Comes with subway-style stainless steel grating or yellow fiberglass grating.
- Floor troughs with gray fiberglass grating available (in place of yellow). To order, add suffix "G" to model number of trough with yellow fiberglass grating. Example: ASFT-1224-FGG
- Floor troughs with ADA-compliant T-Bar fiberglass grating\* available. Gray color. To order, add suffix "-ADA" to end of model number. Example: ASFT-1224-FG-ADA
- Custom sizes available. Consult factory for details.

\* Available for Floor Troughs with Fiberglass Grating only.

### Certifications / Approvals

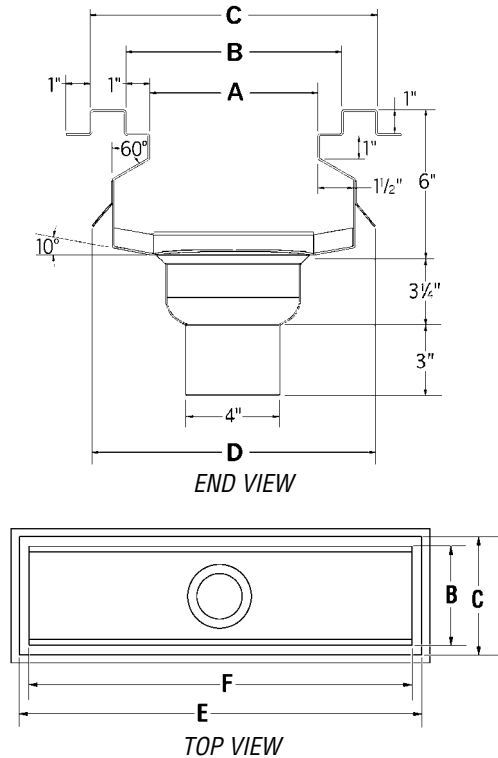




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Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

# Anti-splash Floor Troughs



See chart below for dimensions A through F

### Grating Used in Various Floor Troughs

Floor Trough (dimension E)	Floor Trough (dimension F)	Grating Used - Quantity and Length
18" (457mm)	15" (381mm)	one 15" (381mm)
24" (610mm)	21" (533mm)	one 12" (305mm) and one 9" (229mm)
30" (762mm)	27" (686mm)	three 9" (229mm)
36" (914mm)	33" (838mm)	two 12" (305mm) and one 9" (229mm)
48" (1219mm)	45" (1143mm)	three 12" (305mm) and one 9" (229mm)
60" (1524mm)	57" (1448mm)	four 12" (305mm) and one 9" (229mm)
72" (1829mm)	69" (1753mm)	five 12" (305mm) and one 9" (229mm)
84" (2134mm)	81" (2057mm)	six 12" (305mm) and one 9" (229mm)
96" (2438mm)	93" (2362mm)	seven 12" (305mm) and one 9" (229mm)
120" (3048mm)	117" (2972mm)	nine 12" (305mm) and one 9" (229mm)

12" (305mm)-WIDE TROUGHs		15" (381mm)-WIDE TROUGHs		18" (457mm)-WIDE TROUGHs		24" (610mm)-WIDE TROUGHs		dimension E	dimension F
dimension A: 7" (178mm)	dimension A: 10" (254mm)	dimension A: 10" (254mm)	dimension A: 13" (330mm)	dimension A: 13" (330mm)	dimension A: 19" (483mm)	dimension A: 19" (483mm)	dimension A: 19" (483mm)	in.	mm
dimension B: 9" (229mm)	dimension B: 12" (305mm)	dimension B: 12" (305mm)	dimension B: 15" (381mm)	dimension B: 15" (381mm)	dimension B: 21" (533mm)	dimension B: 21" (533mm)	dimension B: 21" (533mm)	in.	mm
dimension C: 12" (305mm)	dimension C: 15" (381mm)	dimension C: 15" (381mm)	dimension C: 18" (457mm)	dimension C: 18" (457mm)	dimension C: 24" (610mm)	dimension C: 24" (610mm)	dimension C: 24" (610mm)		
dimension D: 11.25" (286mm)	dimension D: 14.25" (362mm)	dimension D: 14.25" (362mm)	dimension D: 17.25" (438mm)	dimension D: 17.25" (438mm)	dimension D: 23.25" (591mm)	dimension D: 23.25" (591mm)	dimension D: 23.25" (591mm)		
WITH YELLOW * FIBERGLASS GRATING	WITH STAINLESS GRATING	WITH YELLOW * FIBERGLASS GRATING	WITH STAINLESS GRATING	WITH YELLOW * FIBERGLASS GRATING	WITH STAINLESS GRATING	WITH YELLOW * FIBERGLASS GRATING	WITH STAINLESS GRATING	model #	model #
model #	model #	model #	model #	model #	model #	model #	model #		
ASFT-1218-FG	ASFT-1218-SG	n/a	n/a	n/a	n/a	n/a	n/a	18"	457
ASFT-1224-FG	ASFT-1224-SG	ASFT-1524-FG	ASFT-1524-SG	ASFT-1824-FG	ASFT-1824-SG	ASFT-2424-FG	ASFT-2424-SG	24"	610
ASFT-1230-FG	ASFT-1230-SG	ASFT-1530-FG	ASFT-1530-SG	ASFT-1830-FG	ASFT-1830-SG	ASFT-2430-FG	ASFT-2430-SG	30"	762
ASFT-1236-FG	ASFT-1236-SG	ASFT-1536-FG	ASFT-1536-SG	ASFT-1836-FG	ASFT-1836-SG	ASFT-2436-FG	ASFT-2436-SG	36"	914
ASFT-1248-FG	ASFT-1248-SG	ASFT-1548-FG	ASFT-1548-SG	ASFT-1848-FG	ASFT-1848-SG	ASFT-2448-FG	ASFT-2448-SG	48"	1219
ASFT-1260-FG	ASFT-1260-SG	ASFT-1560-FG	ASFT-1560-SG	ASFT-1860-FG	ASFT-1860-SG	ASFT-2460-FG	ASFT-2460-SG	60"	1524
ASFT-1272-FG	ASFT-1272-SG	ASFT-1572-FG	ASFT-1572-SG	ASFT-1872-FG	ASFT-1872-SG	ASFT-2472-FG	ASFT-2472-SG	72"	1829
ASFT-1284-FG	ASFT-1284-SG	ASFT-1584-FG	ASFT-1584-SG	ASFT-1884-FG	ASFT-1884-SG	ASFT-2484-FG	ASFT-2484-SG	84"	2134
ASFT-1296-FG	ASFT-1296-SG	ASFT-1596-FG	ASFT-1596-SG	ASFT-1896-FG	ASFT-1896-SG	ASFT-2496-FG	ASFT-2496-SG	96"	2438
ASFT-12120-FG	ASFT-12120-SG	ASFT-15120-FG	ASFT-15120-SG	ASFT-18120-FG	ASFT-18120-SG	ASFT-24120-FG	ASFT-24120-SG	120"	3048

\* To order Floor Trough with Gray Fiberglass Grating, add suffix "G". Example: ASFT1224-FG-G  
 To order Floor Trough with Gray ADA-compliant wide "T" Bar Fiberglass Grating, add suffix "-ADA". Example: ASFT1224-FG-ADA. Available for Floor Troughs with Fiberglass Grating only—NOT for troughs with stainless steel grating.

**EAGLE GROUP**  
 100 Industrial Boulevard, Clayton, DE 19938-8903 USA  
 Phone: 302-653-3000 • Fax: 302-653-2065  
 www.eaglegrp.com

Foodservice Division: Phone 800-441-8440  
 MHC/Retail Display Divisions: Phone 800-637-5100

Spec sheets available for viewing, printing or downloading from our online literature library at [www.eaglegrp.com](http://www.eaglegrp.com)

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## Submittal Sheet

01/09/2023

### ITEM# 23 - FLOOR TROUGH (1 EA REQ'D)

Eagle Group ASFT-2424-FG

Anti-Splash Floor Trough, 24"W x 24"D, yellow fiberglass subway-style grating with non-slip surface, 6" deep trough pan with built-in pitch toward drain, accommodates up to a 4" diameter drain pipe, stainless steel removable perforated basket, all-welded 14/304 stainless steel construction, NSF

The spec sheet for this item can be viewed on item 22)

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	1		ADA-compliant grating (contact factory for price)

#### WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1									

#### WASTE

	INDIRECT SIZE	DIRECT SIZE
1		4"



## Submittal Sheet

01/09/2023

### ITEM# 24 - WIRE SHELVING (4 EA REQ'D)

Eagle Group 2448VG

Shelf, wire, 48"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 800 lbs. capacity, Valu-Gard® green epoxy finish, NSF

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	4	P74-VG	Post, stationary, 74"H, grooved in 1" increments, includes post cap & leveling bolt, Valu-Gard® green epoxy finish, NSF



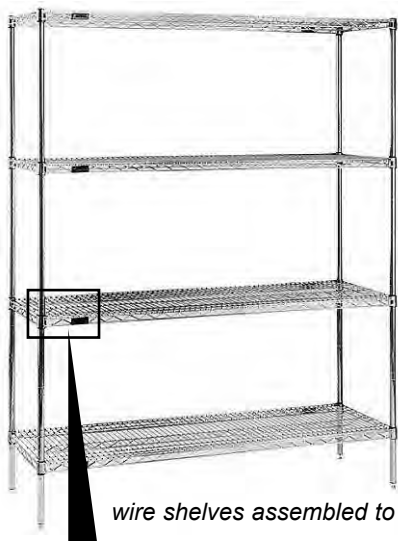
Profit from the Eagle Advantage®

## Specification Sheet

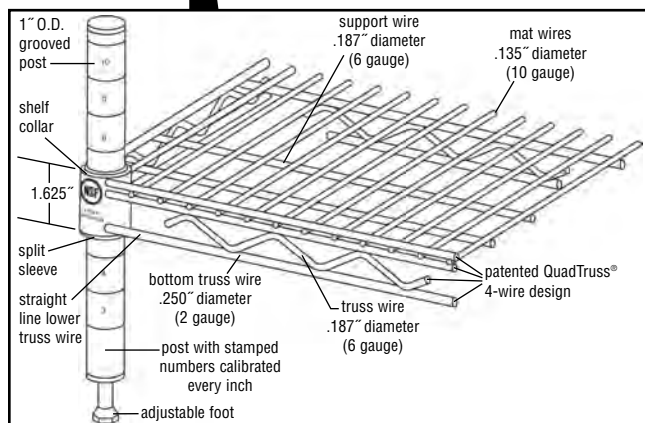
### Short Form Specifications

Eagle Wire Shelf, model \_\_\_\_\_. (EAGLEbrite® Zinc, Chrome, Valu-Master® Grey Epoxy, Valu-Gard® Green Epoxy, EAGLEgard® Green Epoxy with MICROGARD®, or Stainless steel electropolished) finish. Patented QuadTruss® design, with mat wires welded to a four-truss assembly on front and back, and a three-truss assembly on each end.

Eagle Post, model \_\_\_\_\_. (EAGLEbrite® Zinc, Chrome, Valu-Master® Grey Epoxy, Valu-Gard® Green Epoxy, EAGLEgard® Green Epoxy with MICROGARD®, or Stainless steel) finish. Post is 1" diameter, numerically grooved in 1" increments, and includes post cap and leveling bolt.



wire shelves assembled to posts



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Item No.: \_\_\_\_\_  
Project No.: \_\_\_\_\_  
S.I.S. No.: \_\_\_\_\_

## Wire Shelving

### MODELS:

14\*     24\*     P7-\*     P33-\*     P74-\*  
 18\*     30\*     P14-\*     P54-\*     P86-\*  
 21\*     36\*     P18-\*     P63-\*     P96-\*

\* See charts for complete model numbers.

- Patented QuadTruss® design (patent #5,390,803) makes EAGLE shelves up to 25% stronger and provides a retaining ledge for increased storage stability and product retention.
- Assembly: numerically calibrated grooved posts, tapered plastic split sleeves and shelf collars combine to make shelving assembly a simple two-step exercise: 1) Snap the split sleeves onto a post over the number of your choice; and 2) slide a shelf collar over the split sleeves. A positive lock between shelf and post is created without the use of any tools.
- Open-wire construction promotes higher visibility, allows light to pass through the shelves, permits greater air circulation which helps reduce moisture and dust build-up, and increases the effectiveness of fire-suppression systems.
- Tapered split sleeves of high-temperature-resistant ABS plastic create a positive lock that becomes stronger as the load increases.
- Posts are numbered in increments of 1" (25mm) to ensure fast and level assembly.
- Leveling feet are provided to help compensate for uneven floor surfaces.
- Shelf strength: shelf mat utilizes a pincer-type design with the mat wire sandwiched between the two top truss wires, adding significant strength and distributing the entire load without stress and strain on the welds.
- Weight capacities: 800 lbs. (363 kg) for shelves up to 48" (1219mm)-long, evenly distributed static load. 600 lbs. (272 kg) for shelves 54" through 72" (1372 through 1829mm)-long. Shelving units should not exceed 2400 lbs. (1089 kg) per set of four posts.
- Packaging: 24" (610mm) through 48" (1219mm) lengths are packed four to a box. 54", 60" and 72" (1372, 1524 and 1829mm) lengths are packed two to a box.

### Options / Accessories

- Casters     Ledges     Aluminum split sleeves  
 Foot plates     Dividers     Shelf markers  
 "S" hooks     Rods and tabs

### Certifications / Approvals



Government specifications  
MIL-S-40144E



EG01.00 Rev. 04/20



Profit from the Eagle Advantage®

Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

**Wire Shelves**

EAGLE brite®	chrome	Valu-Master®	Valu-Gard®	EAGLE gard®*	stainless steel	width in.	length mm	weight lb.	kg
1424Z	1424C	1424V	1424VG	1424E	1424S	14"	24"	356	6.2
1430Z	1430C	1430V	1430VG	1430E	1430S	14"	30"	356	7.3
1436Z	1436C	1436V	1436VG	1436E	1436S	14"	36"	356	8.4
1442Z	1442C	1442V	1442VG	1442E	1442S	14"	42"	356	9.5
1448Z	1448C	1448V	1448VG	1448E	1448S	14"	48"	356	10.6
1454Z	1454C	1454V	1454VG	1454E	1454S	14"	54"	356	11.7
1460Z	1460C	1460V	1460VG	1460E	1460S	14"	60"	356	12.8
1472Z	1472C	1472V	1472VG	1472E	1472S	14"	72"	356	13.9
1824Z	1824C	1824V	1824VG	1824E	1824S	18"	24"	457	7.3
1830Z	1830C	1830V	1830VG	1830E	1830S	18"	30"	457	8.4
1836Z	1836C	1836V	1836VG	1836E	1836S	18"	36"	457	9.5
1842Z	1842C	1842V	1842VG	1842E	1842S	18"	42"	457	10.6
1848Z	1848C	1848V	1848VG	1848E	1848S	18"	48"	457	11.7
1854Z	1854C	1854V	1854VG	1854E	1854S	18"	54"	457	12.8
1860Z	1860C	1860V	1860VG	1860E	1860S	18"	60"	457	13.9
1872Z	1872C	1872V	1872VG	1872E	1872S	18"	72"	457	15.0
2124Z	2124C	2124V	2124VG	2124E	2124S	21"	24"	533	8.4
2130Z	2130C	2130V	2130VG	2130E	2130S	21"	30"	533	9.5
2136Z	2136C	2136V	2136VG	2136E	2136S	21"	36"	533	10.6
2142Z	2142C	2142V	2142VG	2142E	2142S	21"	42"	533	11.7
2148Z	2148C	2148V	2148VG	2148E	2148S	21"	48"	533	12.8
2154Z	2154C	2154V	2154VG	2154E	2154S	21"	54"	533	13.9
2160Z	2160C	2160V	2160VG	2160E	2160S	21"	60"	533	15.0
2172Z	2172C	2172V	2172VG	2172E	2172S	21"	72"	533	16.1
2424Z	2424C	2424V	2424VG	2424E	2424S	24"	24"	610	9.5
2430Z	2430C	2430V	2430VG	2430E	2430S	24"	30"	610	10.6
2436Z	2436C	2436V	2436VG	2436E	2436S	24"	36"	610	11.7
2442Z	2442C	2442V	2442VG	2442E	2442S	24"	42"	610	12.8
2448Z	2448C	2448V	2448VG	2448E	2448S	24"	48"	610	13.9
2454Z	2454C	2454V	2454VG	2454E	2454S	24"	54"	610	15.0
2460Z	2460C	2460V	2460VG	2460E	2460S	24"	60"	610	16.1
2472Z	2472C	2472V	2472VG	2472E	2472S	24"	72"	610	17.2
3030Z	3030C	3030V	3030VG	3030E	3030S	30"	30"	762	10.6
3036Z	3036C	3036V	3036VG	3036E	3036S	30"	36"	762	11.7
3048Z	3048C	3048V	3048VG	3048E	3048S	30"	48"	762	12.8
3060Z	3060C	3060V	3060VG	3060E	3060S	30"	60"	762	13.9
3072Z	3072C	3072V	3072VG	3072E	3072S	30"	72"	762	15.0
3636Z	3636C	3636V	3636VG	3636E	3636S	36"	36"	914	15.0
3648Z	3648C	3648V	3648VG	3648E	3648S	36"	48"	914	16.1
3660Z	3660C	3660V	3660VG	3660E	3660S	36"	60"	914	17.2
3672Z	3672C	3672V	3672VG	3672E	3672S	36"	72"	914	18.3

**Posts**

Numerically grooved in 1" (25mm) increments. Includes post cap and leveling bolt. For mobile application (excluding 96" posts), add prefix "C" to model number. Example: CP14-E. See Spec Sheet #EG01.05A for information about casters available.

EAGLE brite***	chrome	Valu-Master®	Valu-Gard®	EAGLE gard®*	stainless steel	height in.	mm	weight lb.	kg
P7-Z	P7-C	P7-V	P7-VG	P7-E	P7-S	7"	178	1.0	0.5
P14-Z	P14-C	P14-V	P14-VG	P14-E	P14-S	14"	356	1.0	0.5
P18-Z	P18-C	P18-V	P18-VG	P18-E	P18-S	18"	457	1.5	0.7
P33-Z	P33-C	P33-V	P33-VG	P33-E	P33-S	33"	838	2.0	0.9
P54-Z	P54-C	P54-V	P54-VG	P54-E	P54-S	54"	1372	3.0	1.4
P63-Z	P63-C	P63-V	P63-VG	P63-E	P63-S	63"	1600	3.5	1.6
P74-Z	P74-C	P74-V	P74-VG	P74-E	P74-S	74"	1880	4.0	1.8
P86-Z	P86-C	P86-V	P86-VG	P86-E	P86-S	86"	2184	5.0	2.3
- n/a -	P96-C***	- n/a -	- n/a -	- n/a -	P96-S***	96"	2438	6.0	2.7

\* MICROGARD® standard on all EAGLEgard® posts.  
 \*\* EAGLEbrite® posts are clear epoxy coated for use in dry or wet environments.  
 \*\*\* 96" (2538mm) posts are NOT to be used on units less than 24" (610mm) front-to-back.  
 Recommend using in conjunction with foot plates to affix to floor, and with post clamps where applicable. For stationary use only.

**EAGLE GROUP**

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**Finishes available:**

**Stainless Steel finish**  
 – OUR BEST

- Stainless steel

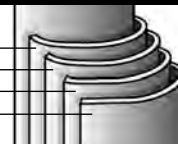


NSF-listed for all environments. Type 304 stainless steel. **15-Year Limited Warranty**

Note: Stainless steel shelving is electropolished.

**Eaglegard® hybrid epoxy**

- Zinc chloride
- Clear chromate
- MasterSeal® sealer
- Blue green hybrid epoxy with MICROGARD®\*

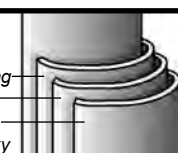


NSF-listed for all environments. Zinc chloride plating followed by clear chromate plating with MasterSeal® sealer, and a final coat of hybrid translucent epoxy with MICROGARD®.

**12-Year Limited Warranty**

**Valu-Master® and Valu-Gard® epoxies**

- Phosphate conversion coating
- MasterSeal® sealer
- Pewter gray (Valu-Master®) or green (Valu-Gard®) epoxy



NSF-listed for wet or dry storage environments. Phosphate conversion coating followed by epoxy coating. **5-Year Limited Warranty**

**Chrome**

- Bright nickel
- Chrome
- Air-dry lacquer



NSF-listed for dry storage environments. Bright nickel plating followed by chrome plating.

**1-Year Limited Warranty**

(NOTE: Optional clear hybrid epoxy, NSF-listed for all environments, is available.)

**Eaglebrite® zinc**

- Zinc chloride
- Clear chromate
- MasterSeal® sealer



NSF-listed for dry storage environments. Bright zinc chloride plating followed by clear chromate plating with MasterSeal® sealer for improved rust protection.

**3-Year Limited Warranty**

(NOTE: Wire shelves feature MasterSeal® sealer. NSF-listed for all environments.)

\* MICROGARD® is an antimicrobial agent which contains built-in protection to retard the growth of a broad range of bacteria, mold and mildew on the surface of the shelves that cause stains, odors and degradation. **STANDARD ON ALL EAGLEGARD® SHELVEING.**



Profit from the Eagle Advantage®

## Specification Sheet

### Short Form Specifications

Eagle Solid Shelving, model \_\_\_\_\_ (Heavy gauge stainless steel, Valu-Master® Gray epoxy, Valu-Gard® Green Epoxy, or Galvanized Steel) with raised "V" edge on all sides and double-hem bending for added strength. Aluminum corner castings to lock shelves to posts with tapered (plastic or aluminum) split sleeves.



*solid shelves and posts combined to form unit*

### Options / Accessories

- Casters with bumper
- Foot plates
- Joining clamps
- Aluminum split sleeves
- Solid shelving ledge
- Solid shelving divider

### EAGLE GROUP

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Item No.: \_\_\_\_\_  
Project No.: \_\_\_\_\_  
S.I.S. No.: \_\_\_\_\_

## Solid Shelving

### MODELS:

- |                                |                                |                                |                                |
|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| <input type="checkbox"/> SS14* | <input type="checkbox"/> P7-*  | <input type="checkbox"/> P54-* | <input type="checkbox"/> P96-* |
| <input type="checkbox"/> SS18* | <input type="checkbox"/> P14-* | <input type="checkbox"/> P63-* |                                |
| <input type="checkbox"/> SS21* | <input type="checkbox"/> P18-* | <input type="checkbox"/> P74-* |                                |
| <input type="checkbox"/> SS24* | <input type="checkbox"/> P33-* | <input type="checkbox"/> P86-* |                                |

\* See charts for complete model numbers.

- Solid shelving is hemmed, has a two-fold thickness of heavy gauge steel, and comes standard with a marine edge providing unsurpassed strength and stability. Aluminum corner castings create the locking mechanism to fasten the shelves to the posts.
- Raised marine edge on all four sides retains contents to shelf, makes cleaning easier and helps reduce the spill of shelf contents.
- Numerically-calibrated grooved posts, tapered plastic or aluminum split sleeves and aluminum corner castings combine to make shelf assembly fast and easy.
- Shelving can be vertically adjusted on 1" (25mm) increments for the entire post length.
- Heavy gauge stainless steel, galvanized steel coated with Valu-Master® pewter gray epoxy or Valu-Gard® green epoxy, or galvanized steel.
- Leveling feet are provided to help compensate for uneven floor surfaces.

### Certifications / Approvals



Government specifications  
MIL-S-40144E

### AUTOQUOTES



EG01.01 Rev. 02/17

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Profit from the Eagle Advantage®

 Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

## Solid Shelving

### Solid Shelves

galvanized	Valu-Master®	Valu-Gard®	stainless steel	width x length		weight	
				in.	mm	lb.	kg
SS1424G	SS1424V	SS1424VG	SS1424S	14" x 24"	356 x 610	10	4.6
SS1430G	SS1430V	SS1430VG	SS1430S	14" x 30"	356 x 762	12	5.5
SS1436G	SS1436V	SS1436VG	SS1436S	14" x 36"	356 x 914	14	6.4
SS1442G	SS1442V	SS1442VG	SS1442S	14" x 42"	356 x 1067	15	6.8
SS1448G	SS1448V	SS1448VG	SS1448S	14" x 48"	356 x 1219	17	7.7
SS1454G	SS1454V	SS1454VG	SS1454S	14" x 54"	356 x 1372	20	9.1
SS1460G	SS1460V	SS1460VG	SS1460S	14" x 60"	356 x 1524	22	10.0
SS1472G	SS1472V	SS1472VG	SS1472S	14" x 72"	356 x 1829	26	11.8
SS1824G	SS1824V	SS1824VG	SS1824S	18" x 24"	457 x 610	11	5.0
SS1830G	SS1830V	SS1830VG	SS1830S	18" x 30"	457 x 762	14	6.4
SS1836G	SS1836V	SS1836VG	SS1836S	18" x 36"	457 x 914	16	7.3
SS1842G	SS1842V	SS1842VG	SS1842S	18" x 42"	457 x 1067	18	8.2
SS1848G	SS1848V	SS1848VG	SS1848S	18" x 48"	457 x 1219	20	9.1
SS1854G	SS1854V	SS1854VG	SS1854S	18" x 54"	457 x 1372	22	10.0
SS1860G	SS1860V	SS1860VG	SS1860S	18" x 60"	457 x 1524	24	10.9
SS1872G	SS1872V	SS1872VG	SS1872S	18" x 72"	457 x 1829	28	12.7
SS2124G	SS2124V	SS2124VG	SS2124S	21" x 24"	533 x 610	13	5.9
SS2130G	SS2130V	SS2130VG	SS2130S	21" x 30"	533 x 762	15	6.8
SS2136G	SS2136V	SS2136VG	SS2136S	21" x 36"	533 x 914	18	8.2
SS2142G	SS2142V	SS2142VG	SS2142S	21" x 42"	533 x 1067	21	9.5
SS2148G	SS2148V	SS2148VG	SS2148S	21" x 48"	533 x 1219	23	10.5
SS2154G	SS2154V	SS2154VG	SS2154S	21" x 54"	533 x 1372	25	11.4
SS2160G	SS2160V	SS2160VG	SS2160S	21" x 60"	533 x 1524	28	12.7
SS2172G	SS2172V	SS2172VG	SS2172S	21" x 72"	533 x 1829	30	13.6
SS2424G	SS2424V	SS2424VG	SS2424S	24" x 24"	610 x 610	15	6.8
SS2430G	SS2430V	SS2430VG	SS2430S	24" x 30"	610 x 762	17	7.7
SS2436G	SS2436V	SS2436VG	SS2436S	24" x 36"	610 x 914	19	8.6
SS2442G	SS2442V	SS2442VG	SS2442S	24" x 42"	610 x 1067	23	10.5
SS2448G	SS2448V	SS2448VG	SS2448S	24" x 48"	610 x 1219	24	10.9
SS2454G	SS2454V	SS2454VG	SS2454S	24" x 54"	610 x 1372	27	12.3
SS2460G	SS2460V	SS2460VG	SS2460S	24" x 60"	610 x 1524	31	14.1
SS2472G	SS2472V	SS2472VG	SS2472S	24" x 72"	610 x 1829	33	15.0



For cleanroom applications, add prefix **CR** to stainless steel model number (ex: **CRSS1424S**).

Electropolished finish available for stainless steel shelves. Consult factory. Please note: Shelf with electropolished finish will have a flat surface without "V" edge.

Contact factory for availability of 72"-long shelves. Availability based on application.

### Posts

Numerically grooved in 1" (25mm) increments. Includes post cap and leveling bolt. For mobile application (excluding 96" posts), add prefix "C" to model number. Example: **CP14-E**. See Spec Sheet #EG01.05 for information about casters available.

EAGLE brite***	chrome	Valu-Master®	Valu-Gard®	EAGLE gard**	stainless steel	height		weight	
						in.	mm	lb.	kg
P7-Z	P7-C	P7-V	P7-VG	P7-E	P7-S	7"	178	1.0	0.5
P14-Z	P14-C	P14-V	P14-VG	P14-E	P14-S	14"	356	1.0	0.5
P18-Z	P18-C	P18-V	P18-VG	P18-E	P18-S	18"	457	1.5	0.7
P33-Z	P33-C	P33-V	P33-VG	P33-E	P33-S	33"	838	2.0	0.9
P54-Z	P54-C	P54-V	P54-VG	P54-E	P54-S	54"	1372	3.0	1.4
P63-Z	P63-C	P63-V	P63-VG	P63-E	P63-S	63"	1600	3.5	1.6
P74-Z	P74-C	P74-V	P74-VG	P74-E	P74-S	74"	1880	4.0	1.8
P86-Z	P86-C	P86-V	P86-VG	P86-E	P86-S	86"	2184	5.0	2.3
- n/a -	P96-C***	- n/a -	- n/a -	- n/a -	P96-S***	96"	2438	6.0	2.7

\* MICROGARD® standard on all EAGLEgard® posts.

\*\* EAGLEbrite® posts are clear epoxy coated for use in dry or wet environments.

\*\*\* 96" (2538mm) posts are NOT to be used on units less than 24" (610mm) front-to-back. Recommend using in conjunction with foot plates to affix to floor, and with post clamps where applicable. For stationary use only!



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## Submittal Sheet

01/09/2023

### ITEM# 25 - THREE (3) COMPARTMENT SINK (1 EA REQ'D)

Eagle Group FN2472-3-30-14/3

Spec-Master® FN Series Sink, three compartment, 138"W x 31"D, 14/304 stainless steel top, coved corners, 24" x 24" x 14" deep compartments, 30" drainboards on left & right, 9-1/2"H backsplash with 1" upturn & tile edge, (2) sets of 8" OC splash mount faucet holes, rolled edges on front & sides, includes 3-1/2" basket drains, stainless steel crossbracing on all sides, stainless steel legs & adjustable bullet feet, NSF

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	1	E101A	Turn down back of splash per table with Z clip
Eagle Group	1	E41A	Disposal provision package, includes: weldment only for cone which are furnished by others, control panel bracket weldment, & holes for pre-rinse & anti-siphon vacuum breaker
T&S Brass	2	B-0290	Sink Mixing Faucet, wall mount, 8" adjustable centers, 12" Big-Flo swing nozzle with plain end outlet, 4-arm kitchen handles with color coded indexes, 00LL street elbows with 3/4" female NPT inlets, ADA Compliant
Eagle Group	1		NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.
Eagle Group	3	-TB	Twist brackets for 3 comp 412, 414 & 314 sinks
Eagle Group	3		add overflow hole punch
T&S Brass	3	B-3952-01	Waste Valve, twist handle, 3-1/2" sink opening, 2" drain outlet with overflow assembly (replaces B-3917-01)
T&S Brass	1	B-0133-B	EasyInstall Pre-Rinse Unit, wall mount. base faucet with spring check cart. & lever handles, 2" dia. flanges with 1/2" NPT female eccentric flanged inlets, 35-1/2"H, 15" overhang, 8-1/4" clearance, 18" riser, (B-0107) spray valve, B-0044-H flex stainless steel hose, 6" wall bracket, quarter-turn Eterna cartridges, low lead
T&S Brass	1	B-0230-K	Installation Kit, (2) 1/2" NPT nipples, lock nuts & washers, (2) short "EII" 1/2" NPT female x male

#### WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1									
2	3/4"			3/4"					
3									
4	1/2"			1/2"					

#### WASTE

	INDIRECT SIZE	DIRECT SIZE
1	(3) 1-1/2"	
2		
3	1-1/2" to 2"	
4		

#### PLUMBING 1 REMARKS

(2) sets of 1-1/8" faucet holes, 8" O.C.

PLUMBING 3 REMARKS

2" NPT Male Thread, 1-1/2 NPT Female Thread Outlet



Profit from the Eagle Advantage®

## Specification Sheet

### Short Form Specifications

Eagle Spec-Master® Three-Compartment Sinks, model \_\_\_\_\_, Unit constructed of 14 gauge 300 series, 18-8 stainless steel throughout. Sink bowls covered with a full  $\frac{5}{8}$ " radius, and shall have a 14" water level. Drainboards, when required, shall be "V" creased for positive drainage. 9 $\frac{1}{2}$ " high backsplash with 1" upturn and tile edge. Legs to be 1 $\frac{1}{2}$ " O.D., stainless steel, with stainless steel gussets, stainless steel crossbracing and adjustable stainless steel bullet feet.



3-compartment sink  
(faucets not included)

### Options / Accessories

- |  |  |
|--|--|
| <input type="checkbox"/> Lever drain               | <input type="checkbox"/> Faucets                     |
| <input type="checkbox"/> Lever drain with overflow | <input type="checkbox"/> Polyboard sink covers       |
| <input type="checkbox"/> Twist handle drains       | <input type="checkbox"/> Stainless steel sink covers |
| <input type="checkbox"/> Overflow hole             | <input type="checkbox"/> Skirted front panel         |
| <input type="checkbox"/> Sink kits                 |  |

### Assembly:

- Entire assembly is fuse-welded and planished, providing a one-piece seamless sink unit.
- Welded areas are high-speed belt blended to match adjacent surfaces with continuity of satin finish.
- All outside corners of assembly are bullnosed to provide safe, clean edges.
- Water supply is  $\frac{1}{2}$ " (13mm) NPS for hot and cold lines.

### EAGLE GROUP

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Phone: 302-653-3000 • Fax: 302-653-2065

www.eaglegrp.com

Foodservice Division: Phone 800-441-8440

MHC/Retail Display Divisions: Phone 800-637-5100

For custom configuration or fabrication needs, contact our **SpecFAB® Division**.

Phone: 302-653-3000 • Fax: 302-653-2065 • e-mail: quotes@eaglegrp.com

**Spec sheets available for viewing, printing or downloading from our online literature library at [www.eaglegrp.com](http://www.eaglegrp.com)**

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Item No.: \_\_\_\_\_  
Project No.: \_\_\_\_\_  
S.I.S. No.: \_\_\_\_\_

## Spec-Master® FN Series Coved Corner Three-Compartment Sinks

### MODELS:

- |                                     |                                     |
|-------------------------------------|-------------------------------------|
| <input type="checkbox"/> FN2048-3-* | <input type="checkbox"/> FN2472-3-* |
| <input type="checkbox"/> FN2054-3-* | <input type="checkbox"/> FN2860-3-* |
| <input type="checkbox"/> FN2060-3-* |                                     |

\* See table on back for complete model numbers.

### Top:

- Drainboards, backsplash and rolled rims are 14 gauge 300 series stainless steel.
- Drainboards, when provided, are integrally welded.
- All rolled edges are highlighted for enhanced appearance.
- 9 $\frac{1}{2}$ " high backsplash with 1" upturn and tile edge.
- 1 $\frac{1}{2}$ " (29mm) faucet holes\* punched on 8" (203mm) centers.

### Base:

- Legs: 1 $\frac{1}{2}$ " (41mm)-diameter stainless steel tubing with stainless steel gussets and fully adjustable stainless steel bullet feet.
- Crossbracing: Adjustable, 1 $\frac{1}{4}$ " (32mm)-diameter stainless steel; running left-to-right and front-to-back.
- Leg locations fall directly under sink bowls\*\*, providing increased stability and maximum weight support.
- Leg gussets welded to a die-cut heavy-gauge stainless steel reinforcing corner plate.
- Legs are crossbraced on all sides for increased stability.

### Sink Bowls:

- 14 gauge 300 series stainless steel.
- 14" (356mm) water level, 17" (432mm) flood level.
- Sink compartments are coved on a full  $\frac{5}{8}$ " (41mm) radius and constructed using state-of-the-art seamless welding techniques.
- Basket-type waste drain fits sink bowls' 3 $\frac{1}{2}$ " (89mm) opening and features 1 $\frac{1}{2}$ " (38mm) outlet.

\* Three-compartment sinks with 20" x 16" (508 x 406mm) bowls have one set of faucet holes. All others feature two sets of faucet holes.

\*\* On sinks with drainboard(s) 30" or longer, legs are located underneath the outer end of drainboard(s).

### Certifications / Approvals



AutoQuotes

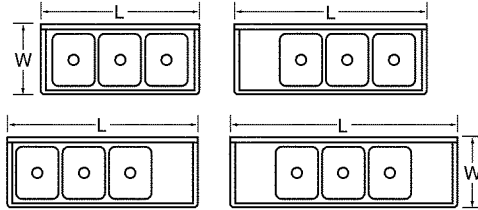




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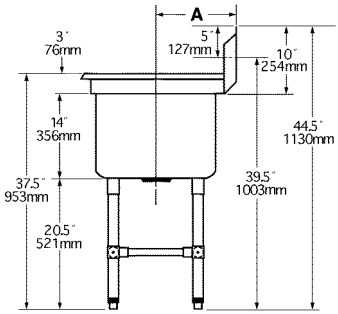
Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

# Spec-Master® FN Series Coved Corner Three-Compartment Sinks



Drain location for rough-in

bowl width	bowl length	Dimension A	
in.	mm	in.	mm
20"	508	16"	406
20"	508	18"	457
20"	508	20"	508
24"	610	24"	610
28"	711	20"	508



model #	BOWL DIMENSIONS				quantity	DRAINBOARD		OVERALL DIMENSIONS				weight	
	width		length			length		width		length		lbs.	kg
	in.	mm	in.	mm		in.	mm	in.	mm	in.	mm		
FN2048-3-14/3	20"	508	16"	406	0	-	-	27"	686	57"	1448	99	44.9
FN2048-3-18R or L-14/3	20"	508	16"	406	1	18"	457	27"	686	73½"	1867	118	53.5
FN2048-3-18-14/3	20"	508	16"	406	2	18"	457	27"	686	90"	2286	137	61.7
FN2048-3-24R or L-14/3	20"	508	16"	406	1	24"	610	27"	686	79½"	2019	124	56.2
FN2048-3-24-14/3	20"	508	16"	406	2	24"	610	27"	686	102"	2591	149	67.6
FN2048-3-30R or L-14/3	20"	508	16"	406	1	30"	762	27"	686	85½"	2172	129	58.5
FN2048-3-30-14/3	20"	508	16"	406	2	30"	762	27"	686	114"	2896	159	72.1
FN2048-3-36R or L-14/3	20"	508	16"	406	1	36"	914	27"	686	91½"	2324	134	60.8
FN2048-3-36-14/3	20"	508	16"	406	2	36"	914	27"	686	126"	3200	169	76.7
FN2054-3-14/3 *	20"	508	18"	457	0	-	-	27"	686	63"	1600	102	46.3
FN2054-3-18R or L-14/3 *	20"	508	18"	457	1	18"	457	27"	686	79½"	2019	121	54.9
FN2054-3-18-14/3 *	20"	508	18"	457	2	18"	457	27"	686	96"	2438	140	63.5
FN2054-3-24R or L-14/3 *	20"	508	18"	457	1	24"	610	27"	686	85½"	2172	127	57.6
FN2054-3-24-14/3 *	20"	508	18"	457	2	24"	610	27"	686	108"	2743	158	71.6
FN2054-3-30R or L-14/3 *	20"	508	18"	457	1	30"	762	27"	686	91½"	2324	132	59.9
FN2054-3-30-14/3 *	20"	508	18"	457	2	30"	762	27"	686	120"	3048	162	73.5
FN2054-3-36R or L-14/3 *	20"	508	18"	457	1	36"	914	27"	686	97½"	2477	137	62.1
FN2054-3-36-14/3 *	20"	508	18"	457	2	36"	914	27"	686	132"	3358	172	78.0
FN2060-3-14/3 *	20"	508	20"	508	0	-	-	27"	686	69"	1753	114	51.7
FN2060-3-18R or L-14/3 *	20"	508	20"	508	1	18"	457	27"	686	85½"	2172	133	60.3
FN2060-3-18-14/3 *	20"	508	20"	508	2	18"	457	27"	686	102"	2591	152	68.9
FN2060-3-24R or L-14/3 *	20"	508	20"	508	1	24"	610	27"	686	91½"	2324	139	63.1
FN2060-3-24-14/3 *	20"	508	20"	508	2	24"	610	27"	686	114"	2896	164	74.4
FN2060-3-30R or L-14/3 *	20"	508	20"	508	1	30"	762	27"	686	97½"	2477	144	65.3
FN2060-3-30-14/3 *	20"	508	20"	508	2	30"	762	27"	686	126"	3200	174	78.9
FN2060-3-36R or L-14/3 *	20"	508	20"	508	1	36"	914	27"	686	103½"	2629	149	67.6
FN2060-3-36-14/3 *	20"	508	20"	508	2	36"	914	27"	686	138"	3505	184	83.5
FN2472-3-14/3 *	24"	610	24"	610	0	-	-	31"	787	81"	2057	127	57.6
FN2472-3-18R or L-14/3 *	24"	610	24"	610	1	18"	457	31"	787	97½"	2477	146	66.2
FN2472-3-18-14/3 *	24"	610	24"	610	2	18"	457	31"	787	114"	2896	165	74.8
FN2472-3-24R or L-14/3 *	24"	610	24"	610	1	24"	610	31"	787	103½"	2629	152	68.9
FN2472-3-24-14/3 *	24"	610	24"	610	2	24"	610	31"	787	126"	3200	177	80.3
FN2472-3-30R or L-14/3 *	24"	610	24"	610	1	30"	762	31"	787	109½"	2769	157	71.2
FN2472-3-30-14/3 *	24"	610	24"	610	2	30"	762	31"	787	138"	3505	187	84.8
FN2472-3-36R or L-14/3 *	24"	610	24"	610	1	36"	914	31"	787	115½"	2934	162	73.5
FN2472-3-36-14/3 *	24"	610	24"	610	2	36"	914	31"	787	150"	3810	197	89.4
FN2860-3-14/3 *	28"	711	20"	508	0	-	-	35"	889	69"	1753	130	59.0
FN2860-3-18R or L-14/3 *	28"	711	20"	508	1	18"	457	35"	889	85½"	2172	149	67.6
FN2860-3-18-14/3 *	28"	711	20"	508	2	18"	457	35"	889	102"	2591	168	76.2
FN2860-3-24R or L-14/3 *	28"	711	20"	508	1	24"	610	35"	889	91½"	2324	155	70.3
FN2860-3-24-14/3 *	28"	711	20"	508	2	24"	610	35"	889	114"	2896	180	81.6
FN2860-3-30R or L-14/3 *	28"	711	20"	508	1	30"	762	35"	889	97½"	2477	160	72.6
FN2860-3-30-14/3 *	28"	711	20"	508	2	30"	762	35"	889	126"	3200	190	86.2
FN2860-3-36R or L-14/3 *	28"	711	20"	508	1	36"	914	35"	889	103½"	2629	165	74.8
FN2860-3-36-14/3 *	28"	711	20"	508	2	36"	914	35"	889	138"	3505	200	90.7

\* Features two sets of faucet holes.

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## Specification Sheet

Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

Catalog Specification Sheet No. **EG20.50**

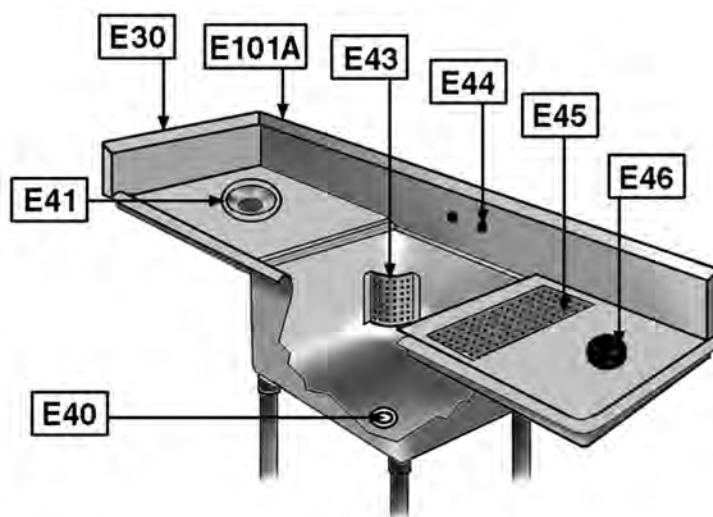
Sink Modifications

### Sink Modifications

#### MODELS:

- |                                 |                               |                              |                               |                              |                                |
|---------------------------------|-------------------------------|------------------------------|-------------------------------|------------------------------|--------------------------------|
| <input type="checkbox"/> E30    | <input type="checkbox"/> E39  | <input type="checkbox"/> E44 | <input type="checkbox"/> E48  | <input type="checkbox"/> E50 | <input type="checkbox"/> E54   |
| <input type="checkbox"/> E37    | <input type="checkbox"/> E40  | <input type="checkbox"/> E45 | <input type="checkbox"/> E48A | <input type="checkbox"/> E51 | <input type="checkbox"/> E55   |
| <input type="checkbox"/> E37A   | <input type="checkbox"/> E41  | <input type="checkbox"/> E46 | <input type="checkbox"/> E49  | <input type="checkbox"/> E52 | <input type="checkbox"/> E56   |
| <input type="checkbox"/> E38-6  | <input type="checkbox"/> E41A | <input type="checkbox"/> E47 | <input type="checkbox"/> E49A | <input type="checkbox"/> E53 | <input type="checkbox"/> E101A |
| <input type="checkbox"/> E38-12 | <input type="checkbox"/> E43  |                              |                               |                              |                                |

Refer to chart below for description of E# models.



#### model # description

<b>E37</b>	NSF sprayed-on latex sound deadening - up to 12' (3658mm)
<b>E37A</b>	- for each additional foot
<b>E38-6 *</b>	Cantilever mount up to 6' (1829mm)
<b>E38-12 *</b>	Cantilever mount up to 12' (3658mm)
<b>E39</b>	Enclosed backsplash
<b>E47</b>	Sink cover holders, sized for stainless steel or poly (includes upper and lower track)
<b>E48</b>	Stainless steel apron, to cover sink bowls - 2 or 3 compartment
<b>E48A</b>	- for each additional compartment over 3
<b>E49</b>	s/s undershelf under drainboards - up to 24" (610mm) w/short legs
<b>E49A</b>	- for each additional foot over 24" (610mm)
<b>E50</b>	Provision for water pump
<b>E51</b>	Optional size drainboard
<b>E52</b>	High backsplash up to 13" (330mm)
<b>E53</b>	High backsplash up to 18" (457mm)
<b>E54</b>	Working height revision

\* Applicable to wall mount shelves and pot racks.

#### model # description

<b>E55</b>	Drainboard corner turn
<b>E56</b>	overflow hole

#### included in illustration above:

#### model # description

<b>E30</b>	End splash - per end, all heights
<b>E40</b>	Provision for sink heater
<b>E41</b>	Disposal provision package—collar
<b>E41A</b>	Disposal provision package—cone
<b>E43</b>	Stand pipe with corner guard, available only on FN-style and utility sinks
<b>E44</b>	Faucet hole revision (adding or moving)
<b>E45</b>	Trough installed in drainboard - up to 30" (762mm) long
<b>E46</b>	Rubber scrap block installed
<b>E101A</b>	Turn down backsplash (per table), includes Z-clips

#### EAGLE GROUP

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#### Certifications / Approvals



(fabricated to NSF-applicable standards)



EG20.50 Rev. 04/10

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**T&S BRASS AND BRONZE WORKS, INC.**  
 2 Saddleback Cove / P.O. Box 1088  
 Travelers Rest, SC 29690

Model No.  
**B-0290**

Item No.

Travelers Rest, SC: 800-476-4103 • Simi Valley, CA: 800-423-0150 • Fax: 864-834-3518 • www.tsbrass.com



**ADA Compliant**

This Space for Architect/Engineer Approval

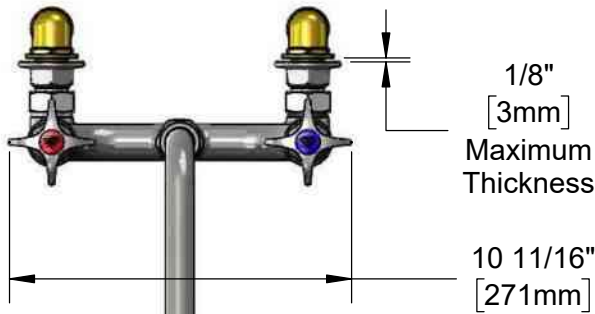
Job Name \_\_\_\_\_ Date \_\_\_\_\_

Model Specified \_\_\_\_\_ Quantity \_\_\_\_\_

Customer/Wholesaler \_\_\_\_\_

Contractor \_\_\_\_\_

Architect/Engineer \_\_\_\_\_



114X  
 12" Big-Flo Swing Nozzle  
 w/ Plain End Outlet.  
 Converts to Rigid with  
 016807-45 Lock Washer  
 (Included)

Big-Flo Cartridges &  
 4-Arm Handles w/  
 Color Coded Indexes

Swivel  
 Joint

4 1/8"  
 [105mm]

8 1/8"  
 [206mm]

12"  
 [305mm]

4 7/16"  
 [113mm]

Ø2" [51mm] Flanges  
 w/ 3/4" NPT Female Inlets

2"  
 [51mm]

8"  
 [203mm]  
 Adjustable from  
 7 3/4" to 8 1/4"  
 [197mm to 210mm]

3/4" NPT Street Elbows

2 1/2"  
 [64mm]

Fits Within  
 2" [51mm]  
 Space

Mounting Surface

Rough-In Requirement:  
 (2) Ø 1 1/4" [32mm] Mounting Holes

Product Specifications:  
 8" Wall Mount Big-Flo Mixing Faucet, Big-Flo Cartridges, 4-Arm  
 Handles, 12" Big-Flo Swing Nozzle & 3/4" NPT Elbow Inlets

Product Compliance:  
 ASME A112.18.1 / CSA B125.1  
 NSF 61 - Section 9  
 NSF 372 (Low Lead Content)  
 ANSI A117.1 (ADA)



**T&S BRASS AND BRONZE WORKS, INC.**

2 Saddleback Cove / P.O. Box 1088  
Travelers Rest, SC 29690

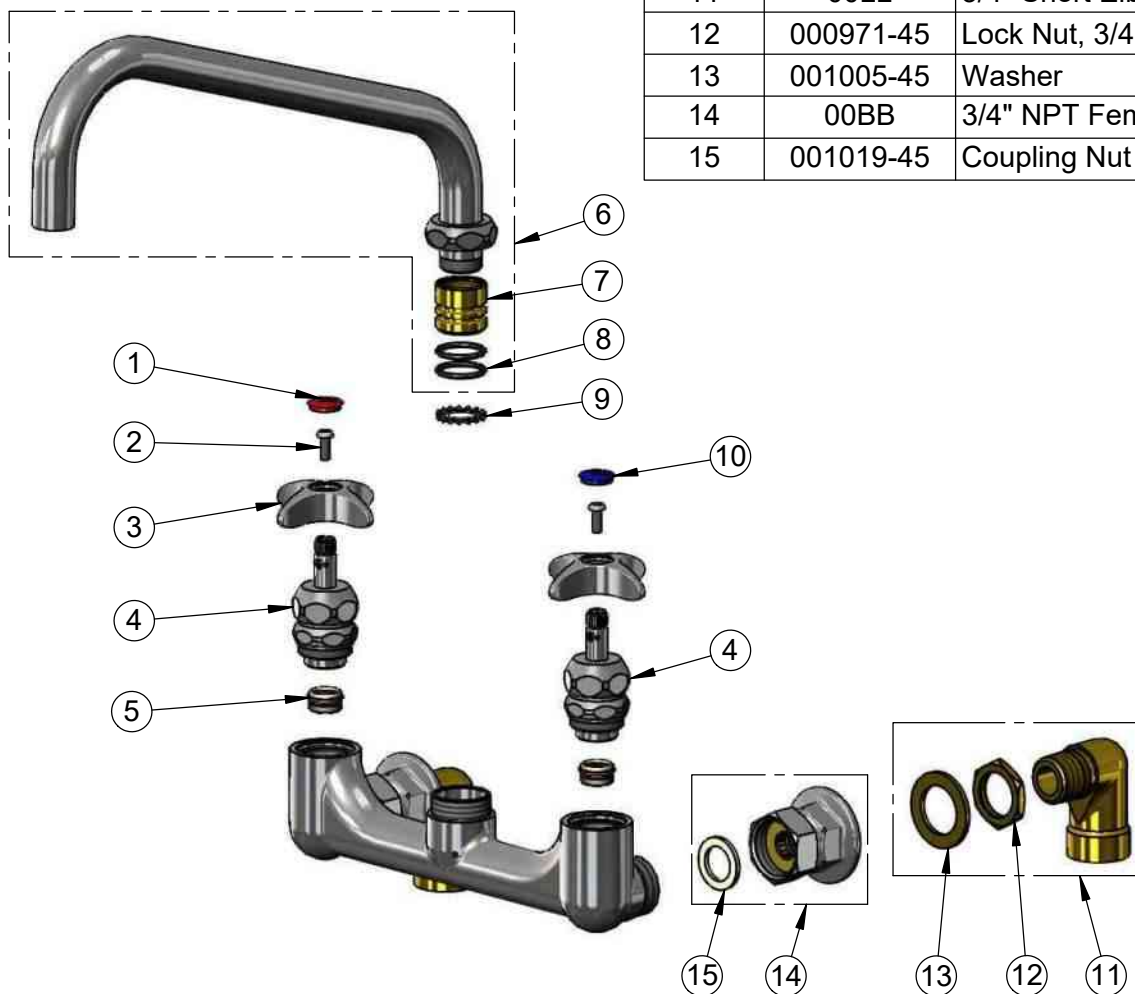
Model No.

**B-0290**

Item No.

Travelers Rest, SC: 800-476-4103 • Simi Valley, CA: 800-423-0150 • Fax: 864-834-3518 • www.tsbrass.com

ITEM NO.	SALES NO.	DESCRIPTION
1	001193-19NS	Red Button Index, Press-in
2	000925-45	Lab Handle Screw
3	002521-45NS	4-Arm Handle (New Style)
4	006482-40NS	Big-Flo Cartridge, RTC
5	000764-20	Seat, Big-Flo
6	114X	12" Big-Flo Swing Nozzle
7	000847-20	Big-Flo Swivel Piece
8	001068-45	O-ring
9	016807-45	Serrated Lock Washer
10	018506-19NS	Blue Button Index, Press-in
11	00LL	3/4" Short Elbow Inlet
12	000971-45	Lock Nut, 3/4" NPSM
13	001005-45	Washer
14	00BB	3/4" NPT Female Eccentric Flange
15	001019-45	Coupling Nut Washer



**Product Specifications:**

8" Wall Mount Big-Flo Mixing Faucet, Big-Flo Cartridges, 4-Arm Handles, 12" Big-Flo Swing Nozzle & 3/4" NPT Elbow Inlets

**Product Compliance:**

ASME A112.18.1 / CSA B125.1  
NSF 61 - Section 9  
NSF 372 (Low Lead Content)  
ANSI A117.1 (ADA)





# T&S BRASS AND BRONZE WORKS, INC.

2 Saddleback Cove / P.O. Box 1088  
Travelers Rest, SC 29690

Model No.

**B-3952-01**

Item No.

Travelers Rest, SC: 800-476-4103 • Simi Valley, CA: 800-423-0150 • Fax: 864-834-3518 • www.tsbrass.com

This Space for Architect/Engineer Approval

Job Name \_\_\_\_\_ Date \_\_\_\_\_

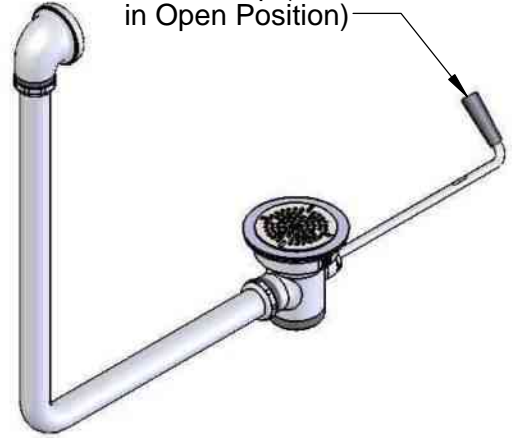
Model Specified \_\_\_\_\_ Quantity \_\_\_\_\_

Customer/Wholesaler \_\_\_\_\_

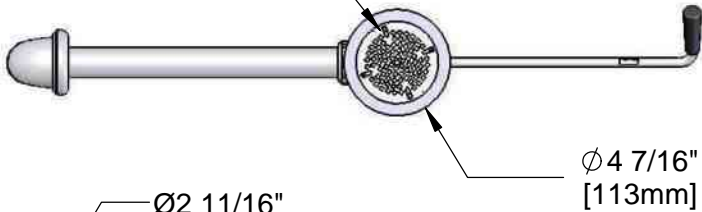
Contractor \_\_\_\_\_

Architect/Engineer \_\_\_\_\_

Twist Handle w/  
Heat Resistant  
Plastic Grip (Shown  
in Open Position)



Removable  
Snap-in Strainer



Ø 4 7/16"  
[113mm]

Ø 2 11/16"  
[68mm]

Ø 1 1/4" [32mm] O.D.  
Overflow Tube

19 1/2"  
[495mm]

12 1/4" ± 1/4"  
[312mm]

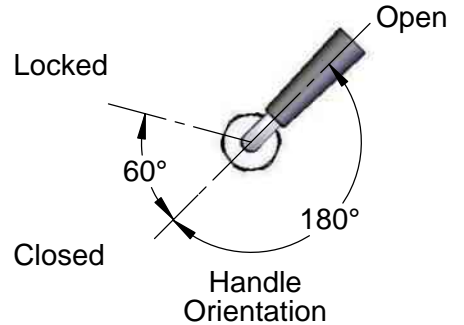
4 1/2"  
[114mm]

2 5/8"  
[67mm]

15 3/8"  
[391mm]

2" NPT Male Thread,  
1-1/2" NPT Female Thread

Ø 2" [51mm]  
Opening Required



Product Specifications:

Rotary Waste Drain Valve w/ Twist Handle, 3 1/2" Sink Opening, 2" Male NPT / 1-1/2" Female NPT Outlet & Overflow Tube & Head

Product Compliance:

ASME A112.18.2 / CSA B125.2





**T&S BRASS AND BRONZE WORKS, INC.**

2 Saddleback Cove / P.O. Box 1088  
Travelers Rest, SC 29690

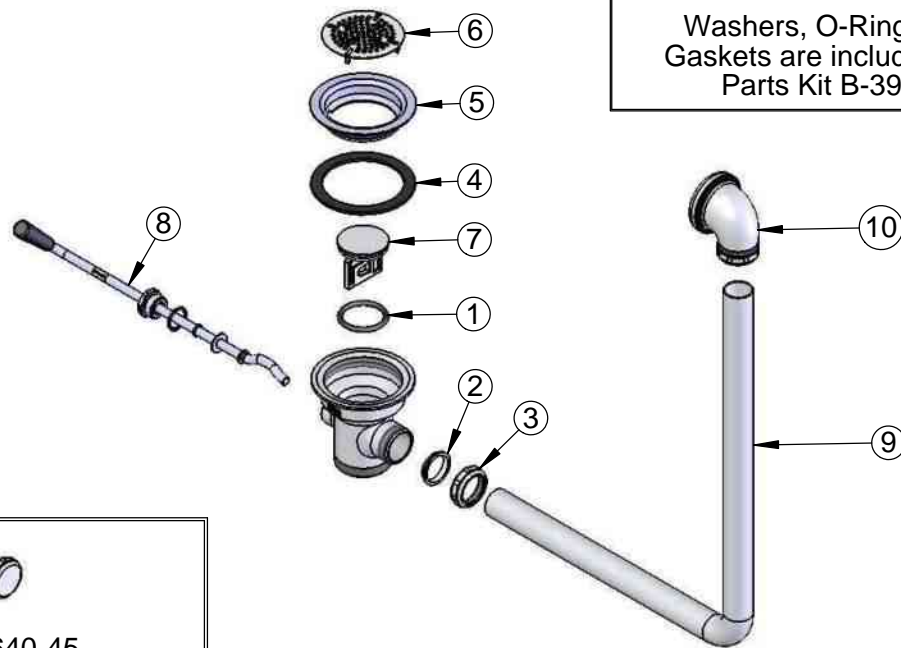
Model No.

**B-3952-01**

Item No.

Travelers Rest, SC: 800-476-4103 • Simi Valley, CA: 800-423-0150 • Fax: 864-834-3518 • www.tsbrass.com

ITEM	SALE NO.	DESCRIPTION
1	010389-45	O-Ring, Plunger
2	010390-45	Ferrule, Coupling Nut
3	010391-45	Nut, Coupling for Twist Drain
4	010382-45	Gasket, 3 1/2" Face Flange
5	010384-45	Flange, 3 1/2" Face
6	010386-45	Strainer, 3 1/2" Snap-in Removable
7	010388-45	Plunger, Lever and Twist Drain
8	010393-45	Handle, Rotary Waste Valve Twist
9	011355-45	Tube, Overflow Elbow
10	011356-45	Head, Overflow Tube



**Product Specifications:**

Rotary Waste Drain Valve w/ Twist Handle, 3 1/2" Sink Opening, 2" Male NPT / 1-1/2" Female NPT Outlet & Overflow Tube & Head

**Product Compliance:**

ASME A112.18.2 / CSA B125.2



**T&S BRASS AND BRONZE WORKS, INC.**

2 Saddleback Cove / P.O. Box 1088  
Travelers Rest, SC 29690

Model No.

**B-0133-B**

Item No.

Travelers Rest, SC: 800-476-4103 • Simi Valley, CA: 800-423-0150 • Fax: 864-834-3518 • www.tsbrass.com

This Space for Architect/Engineer Approval

Job Name \_\_\_\_\_ Date \_\_\_\_\_

Model Specified \_\_\_\_\_ Quantity \_\_\_\_\_

Customer/Wholesaler \_\_\_\_\_

Contractor \_\_\_\_\_

Architect/Engineer \_\_\_\_\_



44" Flexible Stainless Steel Hose w/ Spring & Spray Valve

Items Not Shown for Clarity

Finger Hook

3/8" NPT x 18" Riser

Quarter-Turn Eterna Cartridges w/ Spring Checks & Lever Handles w/ Color Coded Indexes

EasyInstall Lock Nut & Bushing

B-0109-01 6" Wall Bracket

B-0107 1.15 GPM Spray Valve

2 3/8" [61mm]

33 3/8" [848mm]

3 11/16" [94mm]

3 3/4" [95mm]

8" [203mm]

Ø2" [51mm] Flanges w/ 1/2" NPT Female Inlets

14 1/16" [357mm]

Mounting Surface

Adjustable From 7 3/4" to 8 1/4" [197mm to 210mm]

Product Specifications:

Pre-Rinse Unit: EasyInstall 8" Wall Mount Mixing Faucet, Quarter-Turn Eterna Cartridges w/ Spring Checks, Lever Handles, 44" Flexible Stainless Steel Hose, 1.15 GPM Spray Valve, 6" Wall Bracket & 1/2" NPT Female Inlets

Product Compliance:

ASME A112.18.1 / CSA B125.1  
NSF 61 - Section 9  
NSF 372 (Low Lead Content)  
2019 DOE PRSV - Class II



**T&S BRASS AND BRONZE WORKS, INC.**

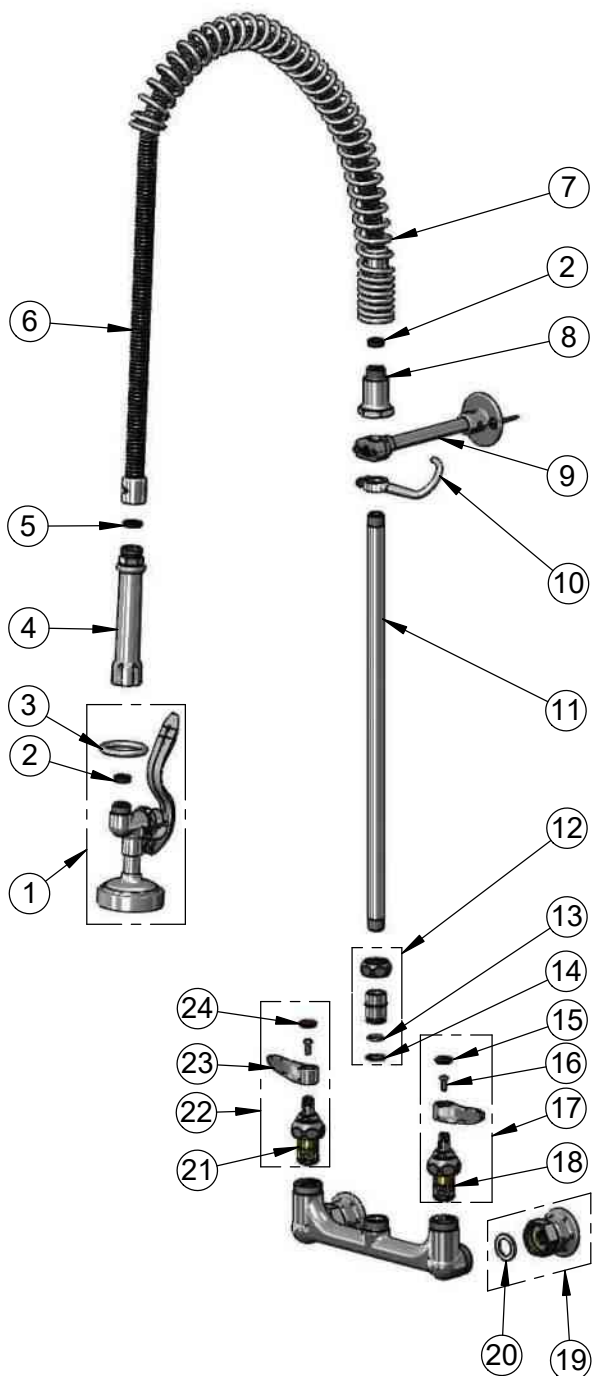
2 Saddleback Cove / P.O. Box 1088  
Travelers Rest, SC 29690

Model No.

**B-0133-B**

Item No.

Travelers Rest, SC: 800-476-4103 • Simi Valley, CA: 800-423-0150 • Fax: 864-834-3518 • www.tsbrass.com



ITEM NO.	SALES NO.	DESCRIPTION
1	B-0107	1.15 GPM Spray Valve
2	010476-45	#27 Washer
3	000907-45	Spray Valve Hold Down Ring
4	002987-40	Grip Handle
5	001014-45	Washer, B-0100 Hose Barrel
6	B-0044-H2A	44" Flexible Stainless Steel Hose, Less Handle
7	000888-45	EasyInstall Overhead Spring
8	000821-40	Spring Body
9	B-0109-01	6" Wall Bracket
10	004R	Finger Hook
11	000369-40	3/8" NPT x 18" Riser
12	EZ-K	EasyInstall Kit
13	001065-45	O-Ring
14	014200-45	Star Washer, Anti-Rotation
15	018506-19NS	Blue Button Index, Press-in
16	000925-45	Lab Handle Screw
17	002711-40NS	Quarter-Turn Eterna Cartridge w/ Spring Check, Handle, Blue Index & Screw, LTC
18	012442-40NS	Quarter-Turn Eterna Cartridge w/ Spring Check, LTC
19	00AA	1/2" NPT Female Eccentric Flange
20	001019-45	Coupling Nut Washer
21	012443-40NS	Quarter-Turn Eterna Cartridge w/ Spring Check, RTC
22	002712-40NS	Quarter-Turn Eterna Cartridge w/ Spring Check, Handle, Red Index & Screw, RTC
23	001638-45NS	Lever Handle (New Style)
24	001193-19NS	Red Button Index, Press-in

**Product Specifications:**  
Pre-Rinse Unit: EasyInstall 8" Wall Mount Mixing Faucet, Quarter-Turn Eterna Cartridges w/ Spring Checks, Lever Handles, 44" Flexible Stainless Steel Hose, 1.15 GPM Spray Valve, 6" Wall Bracket & 1/2" NPT Female Inlets

**Product Compliance:**  
ASME A112.18.1 / CSA B125.1  
NSF 61 - Section 9  
NSF 372 (Low Lead Content)  
2019 DOE PRSV - Class II



## Submittal Sheet

01/09/2023

### ITEM# 26 - DISPOSER (1 EA REQ'D)

InSinkErator SS-200-15B-AS101

SS-200™ Complete Disposer Package, with 15" diameter bowl, 6-5/8" diameter inlet, with sleeve guard & splash baffle, 2 HP motor, stainless steel construction, includes syphon breaker, (2) solenoid valves, (2) flow control valves, programmable AquaSaver® Control Center AS-101 with water-saving technology, automatic water saving function, auto reversing, timed run, post flush, adjustable leg kit

The spec sheet for this item can be viewed on item 12)

### ACCESSORIES

Mfr	Qty	Model	Spec
InSinkErator	1		(3) years parts & labor warranty from date of installation (standard)
InSinkErator	1		Standard height disposer body
InSinkErator	1		Specify voltage
InSinkErator	1	SYPHON 45DEG	Syphon breaker upgrade, chrome, 45° fittings (replace with 13412)

### ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCF
1									2		

### WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1				1/2"					

### WASTE

	INDIRECT SIZE	DIRECT SIZE
1		2"

PROJECT: \_\_\_\_\_ ITEM NO.: \_\_\_\_\_



# ACCESSORIES



## SYPHON BREAKER

Prevents back flow of contaminated water into water line.



## SOLENOID VALVE

Activated when disposer is turned on. Insures water is in grind chamber when disposer is running. Deactivates when disposer is turned off.



## FLOW CONTROL VALVE

Automatically controls the proper amount of water to the disposer for trouble-free operation while limiting excessive water consumption. The valve has an arrow indicating flow direction, and has the GPM (gallons per minute) rating marked on the part. The recommended valve for InSinkErator disposers is as follows:

MODELS	H.P.	STANDARD	OPTIONAL*
SS-50, SS-75	1/2, 3/4	3 GPM	3 GPM
SS-100, SS-125	1, 1 1/4	5 GPM	3 GPM
SS-150, SS200	1 1/2, 2	7 GPM	5 GPM
SS-300, SS500	3, 5	8 GPM	7 GPM
SS750, SS1000	7 1/2, 10	10 GPM	10 GPM

\*Optional **low water consumption flow control** valve may be substituted if water is present from another source, (example: overhead spray) or in a new installation with a short run to the sewer line. Consult InSinkErator factory for more information.

Note: **Flow Control Valve, Syphon Breaker, and Solenoid Valve** are included at **no charge** when a complete disposer package is ordered.



## TIME DELAY RELAY

Provides delay of solenoid valve shut-off to provide a post flush to help prevent drain line stoppages. Beneficial when ground food waste must travel through many bends or a long horizontal run. Adjustable from 0 to 10 minutes.

Our products appear on **The KCL CADalog** CD-ROM based CAD Foodservice Symbol Library. More information is available from **Kochman Consultants, Ltd.** at [www.kclcad.com](http://www.kclcad.com).



4700 21st STREET  
RACINE, WI 53406  
TEL: 800-845-8345  
FAX: 262-554-3620

[www.insinkerator.com](http://www.insinkerator.com)



The Emerson logo is a trademark and a service mark of Emerson Electric Co.



**Submittal Sheet**

01/09/2023

**ITEM# 27 - POT RACK (1 EA REQ'D)**

Eagle Group WM48PR-X

Pot Rack, wall mount, 48"W x 12"D x 16"H, double-bar design, constructed of 3/16" x 2" stainless steel flat bar, includes (8) double-pronged pot hooks, NSF (FLYER)

## ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	1	300696-X	Pot Hook, stainless steel (FLYER)



Profit from the Eagle Advantage®

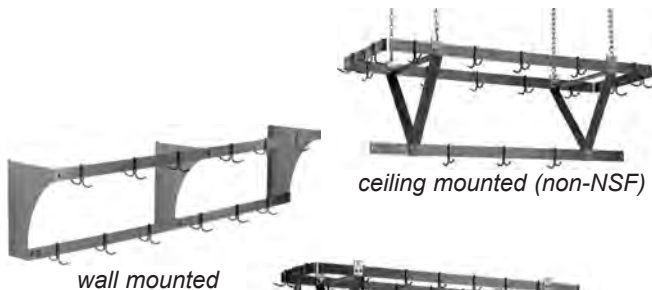
## Specification Sheet

### Short Form Specifications

Eagle Table Mounted Rack, model \_\_\_\_\_.  
Constructed of  $\frac{3}{16}$ " x 2" (aluminum or stainless steel) flat bar, bolted together. Triple bar construction, furnished with one stainless steel double prong sliding pot hook every 12". 1 $\frac{1}{2}$ " O.D. stainless steel tubular supports extend through table and are secured to adjustable undershelf. Available with optional 12" wide 16/304 stainless steel shelf.

Eagle Ceiling Mounted Rack, model \_\_\_\_\_.  
Constructed of  $\frac{3}{16}$ " x 2" (aluminum or stainless steel) flat bar, bolted together. Triple bar construction, furnished with one stainless steel double prong sliding pot hook every 12". Provided with plated chain hangers for ceiling suspension.

Eagle Wall Mounted Rack, model \_\_\_\_\_.  
Constructed of  $\frac{3}{16}$ " x 2" (aluminum or stainless steel) flat bar bolted together. Furnished with one stainless steel double prong sliding pot hook every 12", and provided with stainless steel mounting brackets.



wall mounted

ceiling mounted (non-NSF)



table mounted

### EAGLE GROUP

100 Industrial Boulevard, Clayton, DE 19938-8903 USA

Phone: 302-653-3000 • Fax: 302-653-2065

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Foodservice Division: Phone 800-441-8440

MHC/Retail Display Divisions: Phone 800-637-5100

For custom configuration or fabrication needs, contact our **SpecFAB®** Division.

Phone: 302-653-3000 • Fax: 302-653-3091 • e-mail: specfab@eaglegrp.com

Spec sheets available for viewing, printing or downloading from our online literature library at [www.eaglegrp.com](http://www.eaglegrp.com)

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Item No.: \_\_\_\_\_  
Project No.: \_\_\_\_\_  
S.I.S. No.: \_\_\_\_\_

## Racks

### MODELS:

- |                                 |                                 |                                 |
|---------------------------------|---------------------------------|---------------------------------|
| <input type="checkbox"/> CM36*  | <input type="checkbox"/> TM36*  | <input type="checkbox"/> WM36*  |
| <input type="checkbox"/> CM48*  | <input type="checkbox"/> TM48*  | <input type="checkbox"/> WM48*  |
| <input type="checkbox"/> CM60*  | <input type="checkbox"/> TM60*  | <input type="checkbox"/> WM60*  |
| <input type="checkbox"/> CM72*  | <input type="checkbox"/> TM72*  | <input type="checkbox"/> WM72*  |
| <input type="checkbox"/> CM84*  | <input type="checkbox"/> TM84*  | <input type="checkbox"/> WM84*  |
| <input type="checkbox"/> CM96*  | <input type="checkbox"/> TM96*  | <input type="checkbox"/> WM96*  |
| <input type="checkbox"/> CM108* | <input type="checkbox"/> TM108* | <input type="checkbox"/> WM108* |
| <input type="checkbox"/> CM120* | <input type="checkbox"/> TM120* | <input type="checkbox"/> WM120* |
| <input type="checkbox"/> CM132* | <input type="checkbox"/> TM132* | <input type="checkbox"/> WM132* |
| <input type="checkbox"/> CM144* | <input type="checkbox"/> TM144* | <input type="checkbox"/> WM144* |

\* See charts on back for full model numbers.

### Ceiling mounted (non-NSF)

- Racks are triple-bar construction.
- Supported with plated chain hangers supplied.
- Available in stainless steel or aluminum.
- Provided with double-pronged pot hooks.

### Wall Mounted

- Racks are double-bar construction.
- Supplied with die-formed stainless steel brackets.
- Available in stainless steel or aluminum.
- Provided with double-pronged pot hooks.

### Table Mounted

- Racks are triple-bar construction.
- Front-to-back adjustable crossbracing, plus adjustable undershelf.
- 1 $\frac{1}{2}$ " (41mm) tubular stainless steel supports extend through tabletop and are secured to adjustable undershelf. Units 108" (2743mm) and longer have three supports.
- Provided with double-pronged pot hooks.
- Available in stainless steel or aluminum.

### Options / Accessories

- Additional sliding hooks
- All-welded construction
- 12"-wide adjustable shelves (for Table Mounted Racks)

### Certifications / Approvals



### AUTOQUOTES



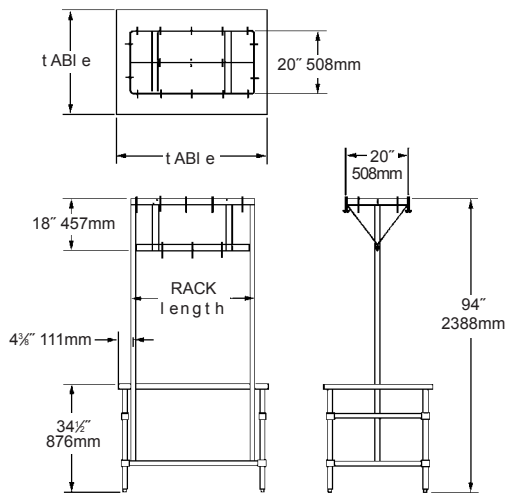
EG10.12 Rev. 06/14





Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

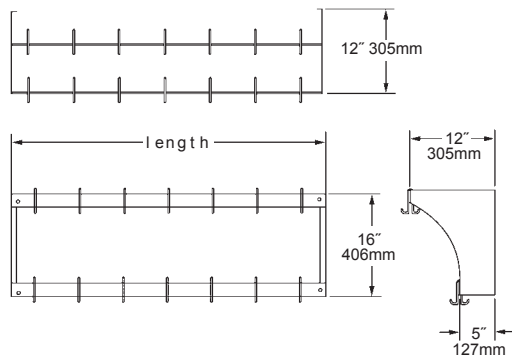
## Table Mounted Racks



ALUMINUM		STAINLESS STEEL		rack length		fits table length	
model #	weight lbs. kg	model #	weight lbs. kg	in.	mm	in.	mm
TM36APR	38 17.2	TM36PR	50 22.7	28"	711	36"	914
TM48APR	42 19.1	TM48PR	57 25.9	40"	1016	48"	1219
TM60APR	46 20.9	TM60PR	64 29.0	52"	1321	60"	1524
TM72APR	50 22.7	TM72PR	70 31.8	64"	1626	72"	1829
TM84APR	54 24.5	TM84PR	77 34.9	76"	1930	84"	2134
TM96APR	58 26.3	TM96PR	83 37.6	88"	2235	96"	2438
TM108APR*	62 28.1	TM108PR*	89 40.4	100"	2540	108"	2743
TM120APR*	66 29.9	TM120PR*	95 43.1	112"	2845	120"	3048
TM132APR*	71 32.2	TM132PR*	102 46.3	124"	3150	132"	3353
TM144APR*	76 34.5	TM144PR*	109 49.4	136"	3454	144"	3658

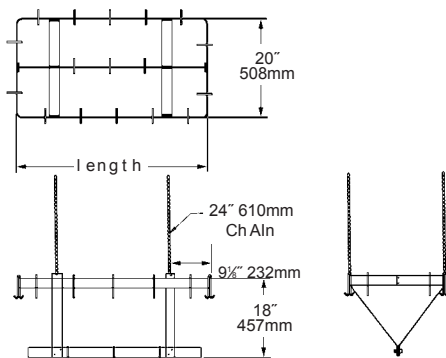
\* These racks include center tubular support.

## Wall Mounted Racks



ALUMINUM		STAINLESS STEEL		rack length	
model #	weight lbs. kg	model #	weight lbs. kg	in.	mm
WM36APR	13 5.8	WM36PR	18 8.2	36"	914
WM48APR	15 6.8	WM48PR	22 10.0	48"	1219
WM60APR	17 7.7	WM60PR	26 11.8	60"	1524
WM72APR	19 8.6	WM72PR	29 13.2	72"	1829
WM84APR	21 9.5	WM84PR	33 15.0	84"	2134
WM96APR	23 10.4	WM96PR	37 16.8	96"	2438
WM108APR	25 11.3	WM108PR	41 18.6	108"	2743
WM120APR	28 12.7	WM120PR	45 20.4	120"	3048
WM132APR	31 14.1	WM132PR	50 22.7	132"	3353
WM144APR	34 15.4	WM144PR	55 24.9	144"	3658

## Ceiling Mounted Racks



ALUMINUM		STAINLESS STEEL		rack length	
model #	weight lbs. kg	model #	weight lbs. kg	in.	mm
CM36APR	28 12.7	CM36PR	41 18.6	28"	711
CM48APR	32 14.5	CM48PR	48 21.8	40"	1016
CM60APR	36 16.3	CM60PR	54 24.5	52"	1321
CM72APR	40 18.1	CM72PR	60 27.2	64"	1626
CM84APR	44 20.0	CM84PR	67 30.4	76"	1930
CM96APR	48 21.8	CM96PR	74 33.6	88"	2235
CM108APR	53 24.0	CM108PR	81 36.7	100"	2540
CM120APR	58 26.3	CM120PR	87 39.5	112"	2845
CM132APR	63 28.6	CM132PR	94 42.6	124"	3150
CM144APR	68 30.8	CM144PR	101 45.8	136"	3454

**EAGLE GROUP**  
 100 Industrial Boulevard, Clayton, DE 19938-8903 USA  
 Phone: 302-653-3000 • Fax: 302-653-2065  
 www.eaglegrp.com

Foodservice Division: Phone 800-441-8440  
 MHC/Retail Display Divisions: Phone 800-637-5100

Spec sheets available for viewing, printing or downloading from our online literature library at [www.eaglegrp.com](http://www.eaglegrp.com)

Although every attempt has been made to ensure the accuracy of the information provided, we cannot be held responsible for typographical or printing errors. Information and specifications are subject to change without notice. Please confirm at time of order.





Profit from the Eagle Advantage®

## Specification Sheet

### Short Form Specifications

Eagle Flex-Master® Overshelf System to consist of 10"- or 12"- wide shelves—16/430 or 16/304 stainless steel, adjustable in 1" increments without the use of tools. Shelves feature split sleeves with a tapered collar for mounting onto posts. Stainless steel posts include mounting plates. Optional stainless steel pot hooks and utility racks available.



worktable shown with  
Flex-Master® overshelf system

### EAGLE GROUP

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For custom configuration or fabrication needs, contact our **SpecFAB®** Division.

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Item No.: \_\_\_\_\_  
Project No.: \_\_\_\_\_  
S.I.S. No.: \_\_\_\_\_

## Flex-Master® Overshelf System for Stainless Steel Worktables

### MODELS:

- |                               |                               |                                 |
|-------------------------------|-------------------------------|---------------------------------|
| <input type="checkbox"/> 4*30 | <input type="checkbox"/> 4*84 | <input type="checkbox"/> 4*14   |
| <input type="checkbox"/> 4*36 | <input type="checkbox"/> 4*96 | <input type="checkbox"/> PRT*-C |
| <input type="checkbox"/> 4*48 | <input type="checkbox"/> 4*10 | <input type="checkbox"/> 4*02   |
| <input type="checkbox"/> 4*60 | <input type="checkbox"/> 4*12 | <input type="checkbox"/> 311915 |
| <input type="checkbox"/> 4*72 | <input type="checkbox"/> 4*13 | <input type="checkbox"/> 300696 |

\* See charts on back page for complete model numbers.

- A totally flexible system for both new and existing operations when versatility is needed.
- A unique custom-style overshelf system utilizing standard components.
- Shipped knocked-down.
- Custom sizes available.

### Overshelves

- 10" and 12" (254 and 305mm) shelf widths can be intermixed on same posts.
- Adjustable height in 1" (26mm) increments for flexible and accurate shelf placement.
- Split sleeves and tapered collars for easy assembly.
- Available in 16/430 and 16/304 stainless steel.

### Posts

- Mounting plates included.
- Calibrated in 1" (25mm) increments.
- Comes in pairs. 30" to 72" (762 to 1829mm) shelves require two pairs of posts. 84" to 120" (2133 to 3048mm) shelves require three pairs of posts. 132" and 144" (3353 and 3658mm) shelves require four pairs of posts.

### Mounting Plates

- Aluminum.
- Accommodates both width shelves.

### Utility Racks

- Chrome plated.

### Pot Hooks

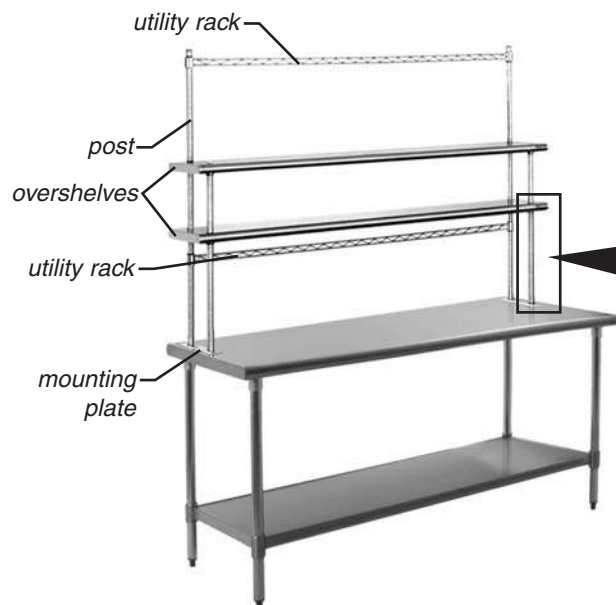
- Stainless steel.

### Certifications / Approvals





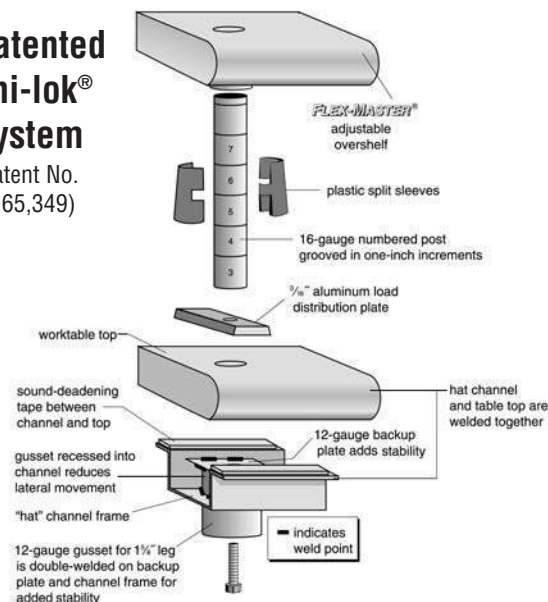
Profit from the Eagle Advantage®



Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

## Patented uni-lok® System

(Patent No. 5,165,349)



## OVERSHELVES

16/430 model #	16/304 model #	width		length		weight	
		in.	mm	in.	mm	lbs.	kg
411030	421030	10"	254	30"	762	10.1	4.6
411036	421036	10"	254	36"	914	12.1	5.5
411048	421048	10"	254	48"	1219	13.1	6.0
411060	421060	10"	254	60"	1524	15.2	6.9
411072	421072	10"	254	72"	1829	17.2	7.8
411084	421084	10"	254	84"	2134	19.3	8.8
411096	421096	10"	254	96"	2438	21.3	9.7
4111010	4211010	10"	254	108"	2743	23.4	10.6
4111012	4211012	10"	254	120"	3048	25.4	11.5
4111013	4211013	10"	254	132"	3353	27.4	12.5
4111014	4211014	10"	254	144"	3658	29.4	13.4
411230	421230	12"	305	30"	762	11.1	5.1
411236	421236	12"	305	36"	914	12.3	5.6
411248	421248	12"	305	48"	1219	14.8	6.7
411260	421260	12"	305	60"	1524	17.2	7.8
411272	421272	12"	305	72"	1829	19.7	9.1
411284	421284	12"	305	84"	2134	22.1	10.0
411296	421296	12"	305	96"	2438	24.6	11.2
411210	421210	12"	305	108"	2743	27.0	12.3
411212	421212	12"	305	120"	3048	29.5	13.4
411213	421213	12"	305	132"	3353	31.5	14.3
411214	421214	12"	305	144"	3658	33.5	15.2

## POSTS

CHROME model #	STAINLESS model #	height		weight	
		in.	mm	lbs.	kg
418202	418002	18"	457	1.7	0.8
430202	430002	30"	762	2.4	1.1
448202	448002	48"	1219	5.6	2.5

## UTILITY RACKS

model #	for overshelf length		weight	
	in.	mm	lbs.	kg
PRT30-C	30"	762	1.7	0.8
PRT36-C	36"	914	1.9	0.9
PRT48-C	48"	1219	2.1	1.0
PRT60-C	60"	1524	2.5	1.1
PRT72-C	72"	1829	2.9	1.3
PRT84-C *	84"	2133	4.1	1.9
PRT96-C *	96"	2438	4.9	2.2
PRT108-C *	108"	2743	5.6	2.5
PRT120-C *	120"	3048	6.2	2.8
PRT132-C **	132"	3353	6.9	3.1
PRT144-C **	144"	3658	7.6	3.5

\* Provided in two sections.

\*\* Provided in three sections.

## POT HOOKS

model #	weight	
	lbs.	kg
300696	0.2	0.1



pot hook

## MOUNTING PLATE

model # 311915

## EAGLE GROUP

100 Industrial Boulevard, Clayton, DE 19938-8903 USA

Phone: 302-653-3000 • Fax: 302-653-2065

www.eaglegrp.com

Foodservice Division: Phone 800-441-8440

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## ***Submittal Sheet***

01/09/2023

### **ITEM# 28 - SHELVING, WALL MOUNTED (1 EA REQ'D)**

Eagle Group WS1248-16/3

Shelf, wall-mounted, 48"W x 12"D, rolled frontedge, 1-1/2"H up-turn on sides & rear, includes stainless steel mounting brackets stud welded to shelf, 16/304 stainless steel construction, NSF

The spec sheet for this item can be viewed on item 15)



***Submittal Sheet***

01/09/2023

**ITEM# 29 - SPARE NO.**

<Spare No.>



## Submittal Sheet

01/09/2023

### ITEM# 30 - FLOOR TROUGH (1 EA REQ'D)

Eagle Group ASFT-1248-FG

Anti-Splash Floor Trough, 48"W x 12"D, yellow fiberglass subway-style grating with non-slip surface, 6" deep trough pan with built-in pitch toward drain, accommodates up to a 4" diameter drain pipe, stainless steel removable perforated basket, all-welded 14/304 stainless steel construction, NSF

The spec sheet for this item can be viewed on item 22)

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	1		ADA-compliant grating

#### WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1									

#### WASTE

	INDIRECT SIZE	DIRECT SIZE
1		4"



## Submittal Sheet

01/09/2023

### ITEM# 31 - HOSE REEL (1 EA REQ'D)

T&amp;S Brass B-7133-07

Hose Reel System, open, 1/2" x 35' hose with stainless steel front trigger spray valve (with a 9/16" orifice), with ratcheting system & adjustable hose bumper, stainless steel

#### ACCESSORIES

Mfr	Qty	Model	Spec
T&S Brass	1		1 year limited warranty for hose, standard
T&S Brass	1		2 year limited warranty for hose reel, standard

### WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1	1/2"								

### WASTE

	INDIRECT SIZE	DIRECT SIZE
1		



**T&S BRASS AND BRONZE WORKS, INC.**  
 2 Saddleback Cove / P.O. Box 1088  
 Travelers Rest, SC 29690

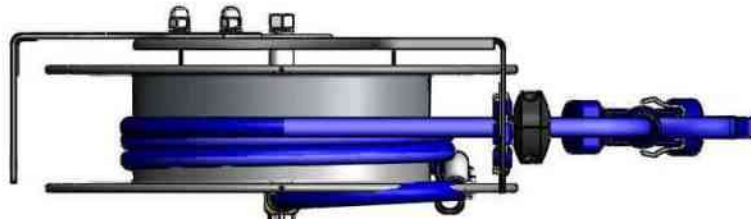
Model No.  
**B-7133-07**

Item No.

Travelers Rest, SC: 800-476-4103 • Simi Valley, CA: 800-423-0150 • Fax: 864-834-3518 • www.tsbrass.com

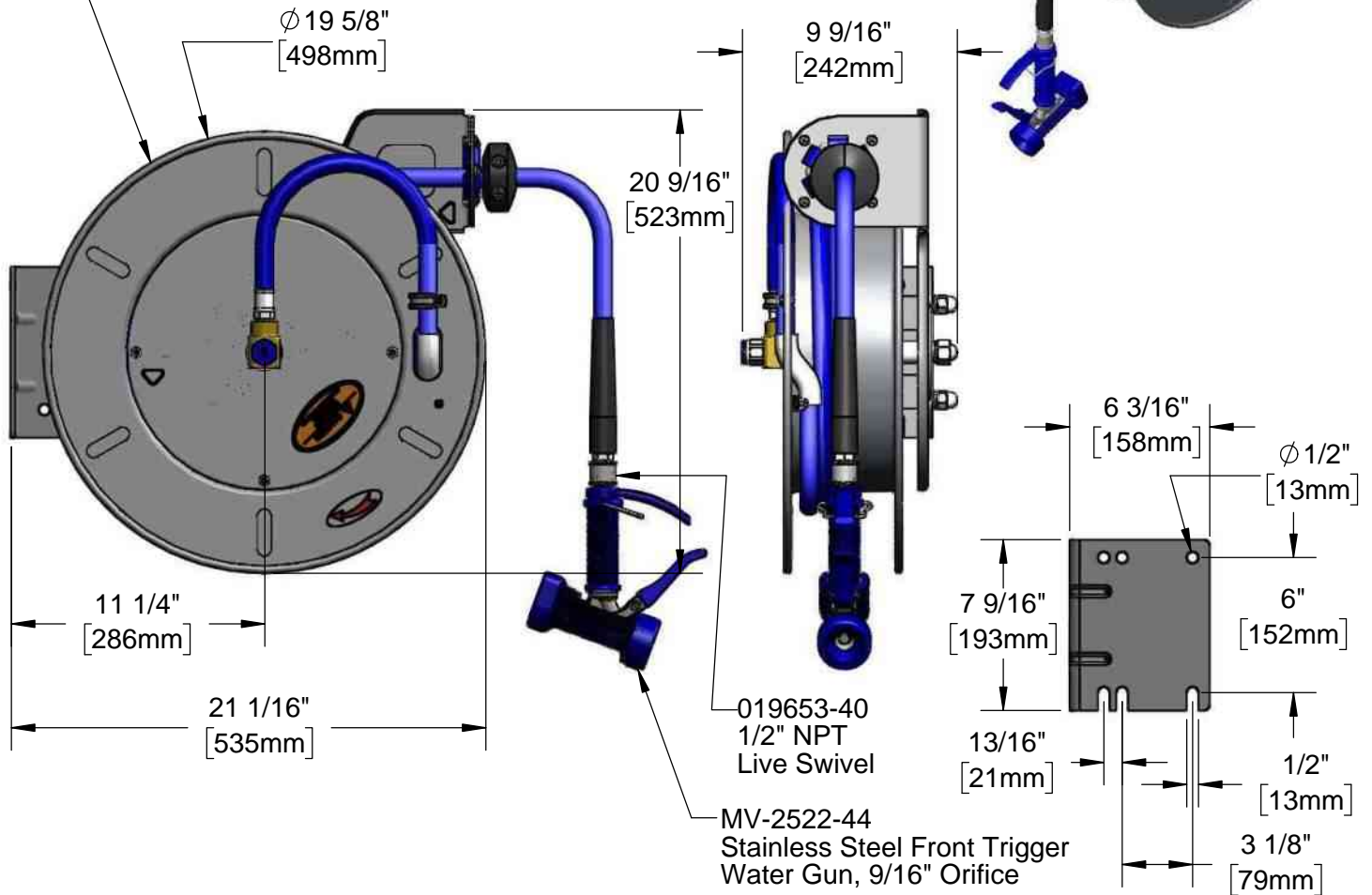
This Space for Architect/Engineer Approval

Job Name \_\_\_\_\_ Date \_\_\_\_\_  
 Model Specified \_\_\_\_\_ Quantity \_\_\_\_\_  
 Customer/Wholesaler \_\_\_\_\_  
 Contractor \_\_\_\_\_  
 Architect/Engineer \_\_\_\_\_



1/2" NPT Female Inlet  
 (Left Side of Reel)

Open Stainless Steel Hose Reel  
 35' of 1/2" Hose



**Product Specifications:**  
 1/2" x 35' Open Stainless Steel Reel w/ Stainless Steel Front Trigger Water Gun with Rubber Cover & Swivel, 9/16" Flow Orifice and 1/2" NPT Female Inlet

**Product Compliance:**  
 NSF 61 Exempt (Non-Potable)



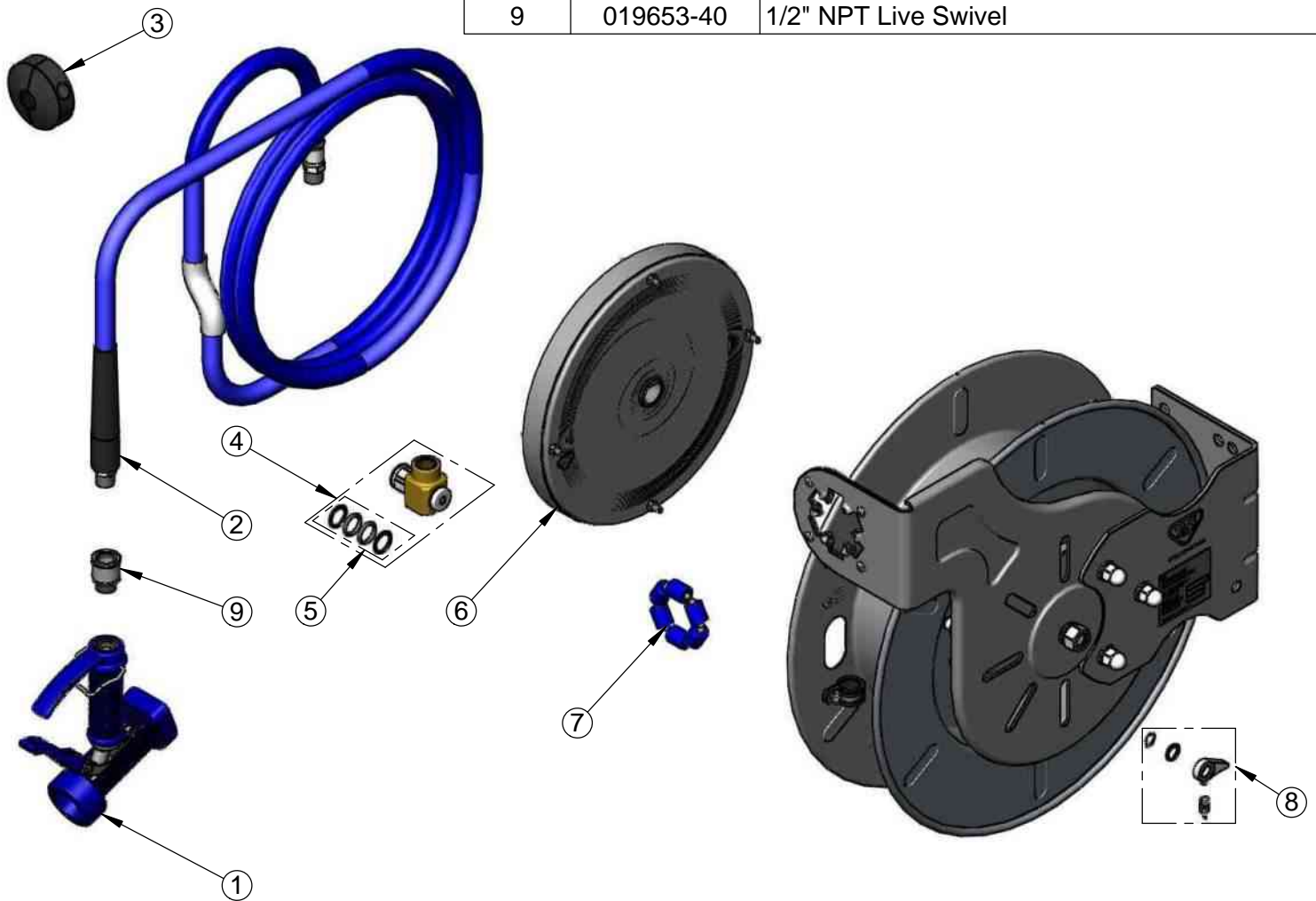


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 Travelers Rest, SC 29690

Model No.  
**B-7133-07**  
 Item No.

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ITEM NO.	SALES NO.	DESCRIPTION
1	MV-2522-44	Stainless Steel Front Trigger Water Gun w/ Blue Rubber Cover, 9/16" Flow Orifice
2	015089-45	1/2" x 35' Hose Replacement Kit
3	019499-45	1/2" Hose Stop Repair Kit
4	014947-45	1/2" Swivel Repair Kit
5	019473-45	O-Ring Replacement Kit
6	014935-45	Large Stainless Steel Spring
7	014938-45	Roller Replacement Kit
8	014940-45	Ratchet Repair Kit
9	019653-40	1/2" NPT Live Swivel



**Product Specifications:**  
 1/2" x 35' Open Stainless Steel Reel w/ Stainless Steel Front Trigger Water Gun with Rubber Cover & Swivel, 9/16" Flow Orifice and 1/2" NPT Female Inlet

**Product Compliance:**  
 NSF 61 Exempt (Non-Potable)





## Submittal Sheet

01/09/2023

### ITEM# 32 - MOP SINK (1 EA REQ'D)

Eagle Group F2820-12-X

Mop Sink, floor mount, 32-5/8"L x 25-1/2" W x 19-1/2"H overall, 28" wide x 20" front-to-back x 12" deep bowl, 16 gauge top with "V" edge, full skirt, 2" NPS drain with stainless steel removable strainer plate, 304 stainless steel construction, NSF (FLYER)

### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	1		NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.
Eagle Group	1	312688-X	Mop Holder, 18"W, holds (3) mops (FLYER)



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## Specification Sheet

### Short Form Specifications

Eagle Floor Mounted Mop Sink, model \_\_\_\_\_.  
Constructed of type 304 stainless steel, with 8" or 12" deep-drawn covered corner sink with drain and flat strainer plate.



#F1916 mop sink

### Options / Accessories

- 3-Pole mop holder
- 4-Pole mop holder
- Hose and bracket
- Service faucet
- Splash kit

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Item No.: \_\_\_\_\_  
Project No.: \_\_\_\_\_  
S.I.S. No.: \_\_\_\_\_

## Mop Sinks

### MODELS:

- |                                   |                                 |                                 |                                 |
|-----------------------------------|---------------------------------|---------------------------------|---------------------------------|
| <input type="checkbox"/> F1916    | <input type="checkbox"/> 312688 | <input type="checkbox"/> 503095 | <input type="checkbox"/> 503099 |
| <input type="checkbox"/> F1916-12 | <input type="checkbox"/> 321561 | <input type="checkbox"/> 503096 | <input type="checkbox"/> 503100 |
| <input type="checkbox"/> F2820    | <input type="checkbox"/> 312689 | <input type="checkbox"/> 503097 |                                 |
| <input type="checkbox"/> F2820-12 | <input type="checkbox"/> 312690 | <input type="checkbox"/> 503098 |                                 |

### Sink Bowl

- Heavy gauge type 304 stainless steel.
- Deep-drawn one piece seamless construction, using state-of-the-art hydraulic presses.
- Generous radius with a minimum dimension of 3" (76mm), rectangular for maximum capacity.
- Drain is 2" (51mm) NPS nickel-plated cast bronze body, with removable snap-on stainless steel flat strainer plate.
- Models #F1916 and F2820 feature 8" (203mm) water level with 8¾" (222mm) flood level. Models #F1916-12 and F2820-12 feature 12" (610mm) water level with 12¾" (324mm) flood level.

### Top

- 16 gauge type 304 stainless steel.
- Exclusive anti-splash double-offset "V" edge prevents spillage.

### Skirt

- Heavy gauge type 304 stainless steel.
- Stud-bolted to underside of top in a concealed manner, providing a clean visual appearance.
- Full skirt allows for tight sanitary seal.

### Design and Construction Features

- A superior floor sink designed for institutional use as well as those installations which require quality and durability.
- Entire top assembly is fused, welded, and planished, providing a one-piece seamless floor sink.
- Welded areas are high-speed belt blended to match adjacent surfaces with continuity of satin finish.
- Water supply is ½" (13mm) IPS for hot and cold lines.
- Wall-mount faucets are available as options.

### Certifications / Approvals



**AUTOQUOTES**

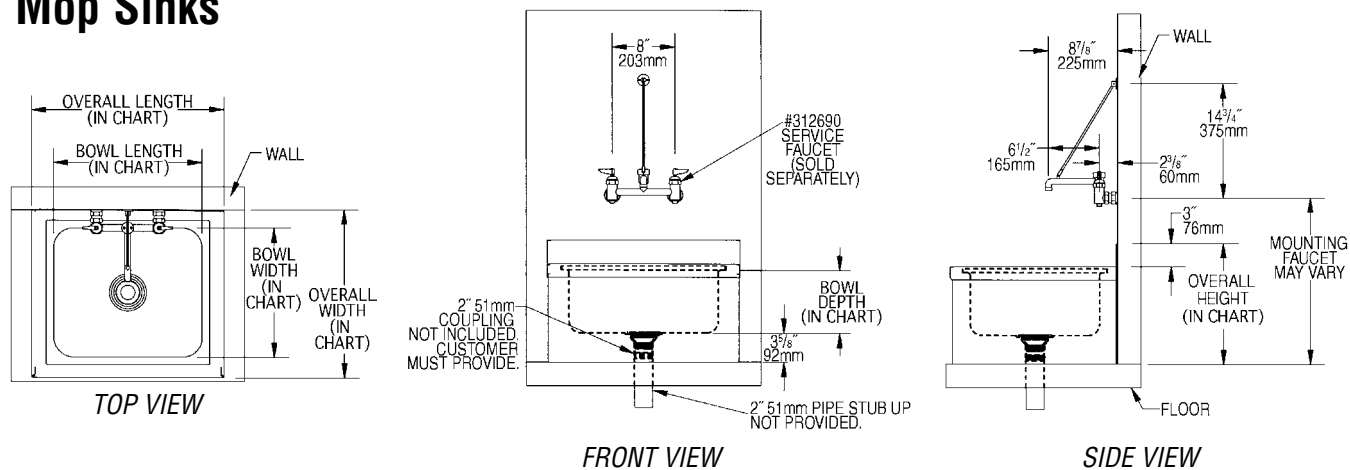




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Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

## Mop Sinks



model #	bowl size		overall size		weight lbs. kg
	width in.	length x depth mm	width in.	length x height mm	
<b>F1916</b>	16" x 20" x 8"	406 x 508 x 203	21 1/2" x 24 3/4" x 15 1/2"	546 x 625 x 394	35 15.8
<b>F1916-12</b>	16" x 20" x 12"	406 x 508 x 305	21 1/2" x 24 3/4" x 19 1/2"	546 x 625 x 495	53 24.0
<b>F2820</b>	20" x 28" x 8"	508 x 711 x 203	25 1/2" x 32 3/4" x 15 1/2"	648 x 829 x 394	68 30.8
<b>F2820-12</b>	20" x 28" x 12"	508 x 711 x 305	25 1/2" x 32 3/4" x 19 1/2"	648 x 829 x 495	86 39.0

### Optional Accessories for Mop Sinks

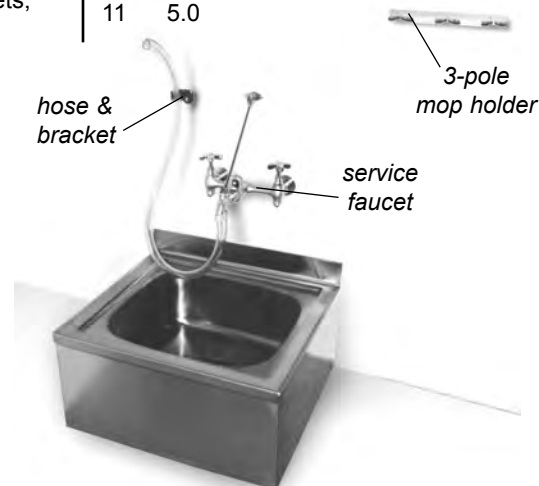
model #	description	weight	
		lbs.	kg
<b>312688</b>	3-pole mop holder, 18" x 4" (457 x 102mm), projects out 1 3/8" (35mm)	4	1.8
<b>321561</b>	4-pole mop holder, 24" x 4" (610 x 102mm), projects out 1" (25mm)	4.5	2.0
<b>312689</b>	Hose & bracket, 30" (762mm) length	8	3.6
<b>312690</b>	Service faucet, 8" (203mm) center, 1/2" (13mm) NPT female inlets, comes with vacuum breaker	11	5.0

### 16" Splash Kits

16/304 stainless steel. 3" (76mm) radius on front of splashes. Kits come with hardware for attaching to mop sink.



description	fits "F1916"	fits "F2820"
	Mop Sinks	Mop Sinks
left and rear splash kit	<b>503095</b>	<b>503098</b>
right and rear splash kit	<b>503096</b>	<b>503099</b>
left, right and rear splash kit	<b>503097</b>	<b>503100</b>



### EAGLE GROUP

100 Industrial Boulevard, Clayton, DE 19938-8903 USA

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Foodservice Division: Phone 800-441-8440

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***Submittal Sheet***

01/09/2023

**ITEM# 33 - SPARE NO.**

<Spare No.>



***Submittal Sheet***

01/09/2023

**ITEM# 34 - SPARE NO.**

<Spare No.>



## Submittal Sheet

01/09/2023

### ITEM# 36 - UNIVERSAL PAN RACK (8 EA REQ'D)

Eagle Group 4339

Lifetime Series Bun Pan Rack, universal, 21-1/2" x 26" x 73"H, (20) 18" x 26" or (19) 12" x 20" pan capacity, (40) 13" x 18" pan capacity or (40) 14" x 18" tray capacity, slides on 3" centers, fully welded aluminum construction, (4) 6" x 2" non-marking swivel plate casters, NSF

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	8		NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.



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## Specification Sheet

### Short Form Specifications

Eagle LIFETIME Series Universal Pan Rack, model \_\_\_\_\_ . Constructed of heavy duty 6063-T5 aluminum alloy. Fully welded frame, 1" square tubular crossbracing, base consists of 1½" x 1½" square aluminum tubing with pretapped caster plates welded inside, and ¾"-wide aluminum slides welded to frame. Lifetime guarantee against rust, corrosion, workmanship and material defects.



LIFETIME Series universal pan rack

### Options / Accessories

- Pan stops
- Rotary bumpers
- Perimeter bumper
- Casters with brakes
- Vertical corner bumper

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MHC/Retail Display Divisions: Phone 800-637-5100

For custom configuration or fabrication needs, contact our SpecFAB® Division.

Phone: 302-653-3000 • Fax: 302-653-3091 • e-mail: specfab@eaglegrp.com

Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

## LIFETIME Series Universal Pan Racks

### MODELS:

- 4339
- 4340

### Design and Construction Features

- LIFETIME GUARANTEE against:
  - rust and corrosion
  - material defects and workmanship
- These racks accommodate a variety of sheet pan sizes.
- All heavy duty type 6063-T5 alloy aluminum welded construction.
- Fully-welded frame features 1½" x 1¾" (38 x 45mm) heavy-duty "D"-shaped tube construction.
- Unit base consists of 1¼" x 1½" (32 x 38mm) square aluminum tubing with pretapped caster plates welded inside.
- ¾" (83mm)-wide aluminum angle slides are welded to frame.
- Three welds per angle connection.
- Crossbracing consists of 1" (25mm) square tubing.
- Heavy duty 6" x 2" (152 x 51mm) non-marking swivel plate casters.

### Certifications / Approvals



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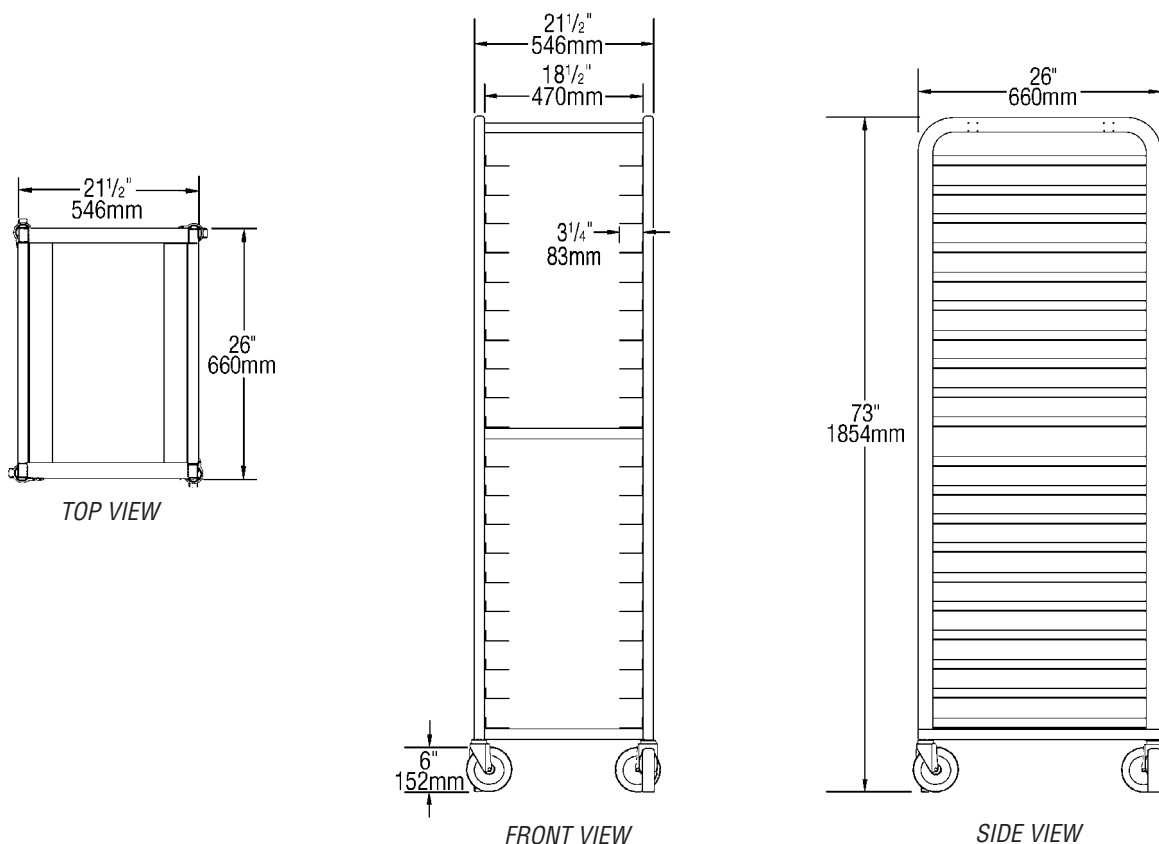
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Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

## LIFETIME Series Universal Pan Racks



model #	overall dimensions			weight	sliding space	pan/tray capacity								
	width	depth	height			12" x 20"	18" x 26"	13" x 18"	14" x 18"					
	in.	mm	in.	mm	in.	mm	pan	pan	pan	tray				
4339	21½"	546	26"	660	73"	1854	92	41.7	3"	76	19	20	40	40
4340	21½"	546	26"	660	73"	1854	74	33.6	5"	127	11	12	24	24

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01/09/2023

**ITEM# 37 - SPARE NO.**

<Spare No.>



***Submittal Sheet***

01/09/2023

**ITEM# 38 - SPARE NO.**

<Spare No.>



***Submittal Sheet***

01/09/2023

**ITEM# 39 - VENTILATION SYSTEM (1 EA REQ'D)**

Captive-Aire



***Submittal Sheet***

01/09/2023

**ITEM# 40 - FIRE SUPPRESSION (2 EA REQ'D)**

Custom

price included in item #39



***Submittal Sheet***

01/09/2023

**ITEM# 41 - UDS (1 EA REQ'D)**

Captive Aire

Utility distribution system



## Submittal Sheet

01/09/2023

### ITEM# 42 - FAUCET, KETTLE / POT FILLER (2 EA REQ'D)

T&amp;S Brass B-0610-CR

Pot Filler, splash/wall mount, 8" OC, 68" flexible stainless steel hose with hook nozzle, lever handles, Cerama cartridges with check valves, vacuum breaker, 1/2" NPT female inlets, low lead

### WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1	1/2"			1/2"					

### WASTE

	INDIRECT SIZE	DIRECT SIZE
1		



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 2 Saddleback Cove / P.O. Box 1088  
 Travelers Rest, SC 29690

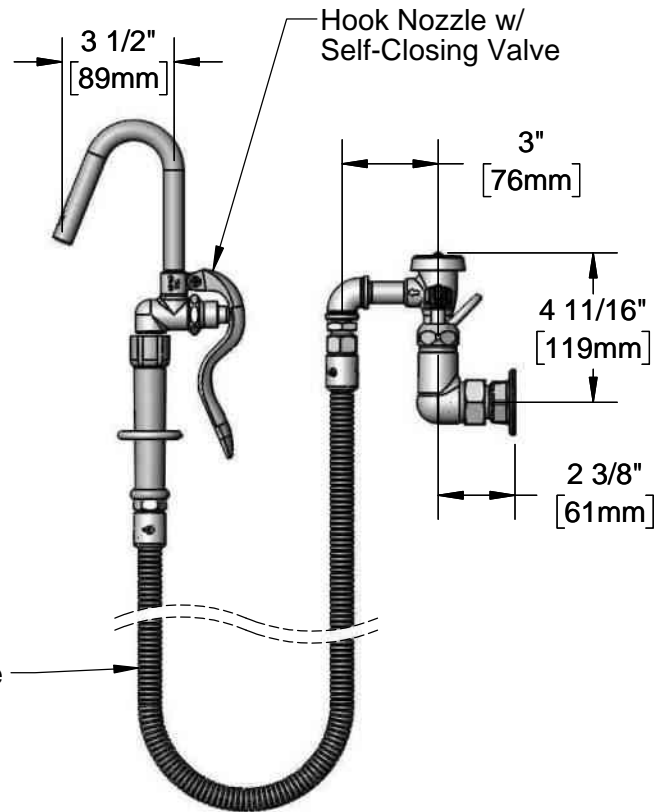
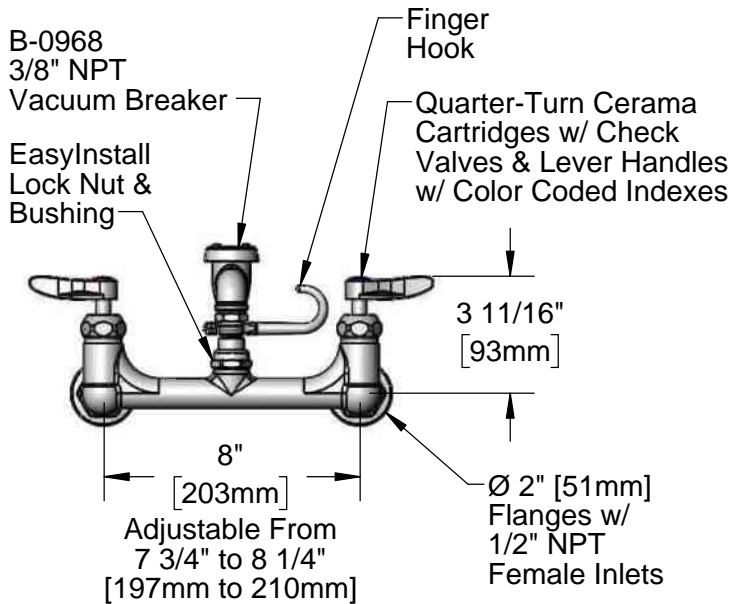
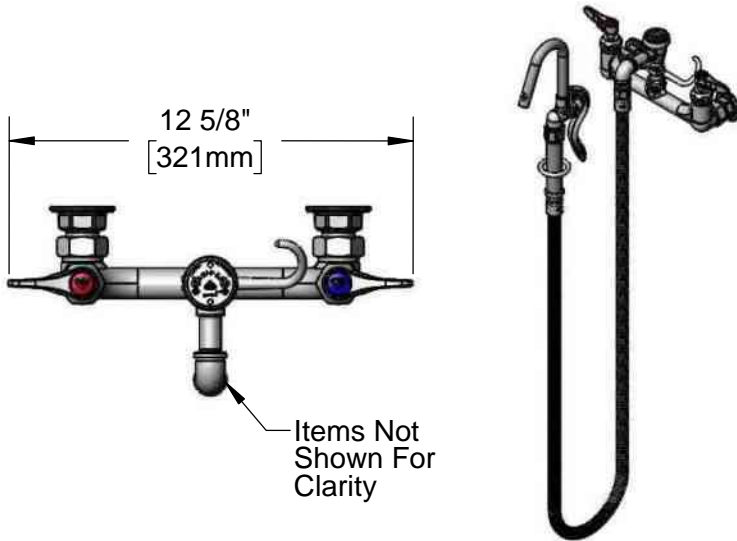
Model No.  
**B-0610-CR**

Item No.

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This Space for Architect/Engineer Approval

Job Name \_\_\_\_\_ Date \_\_\_\_\_  
 Model Specified \_\_\_\_\_ Quantity \_\_\_\_\_  
 Customer/Wholesaler \_\_\_\_\_  
 Contractor \_\_\_\_\_  
 Architect/Engineer \_\_\_\_\_



**Product Specifications:**  
 Kettle & Pot Filler Wall Mount Faucet, Quarter-Turn Cerama Cartridges w/ Check Valves, Lever Handles, 3/8" NPT Vacuum Breaker, 68" Flexible Stainless Steel Hose, Hook Nozzle & 1/2" NPT Female Inlets

**Product Compliance:**  
 ASME A112.18.1 / CSA B125.1  
 NSF 61 - Section 9  
 NSF 372 (Low Lead Content)  
 ASSE 1001 (VB)  
 EPA Act 2005 Non-Compliant



# T&S BRASS AND BRONZE WORKS, INC.

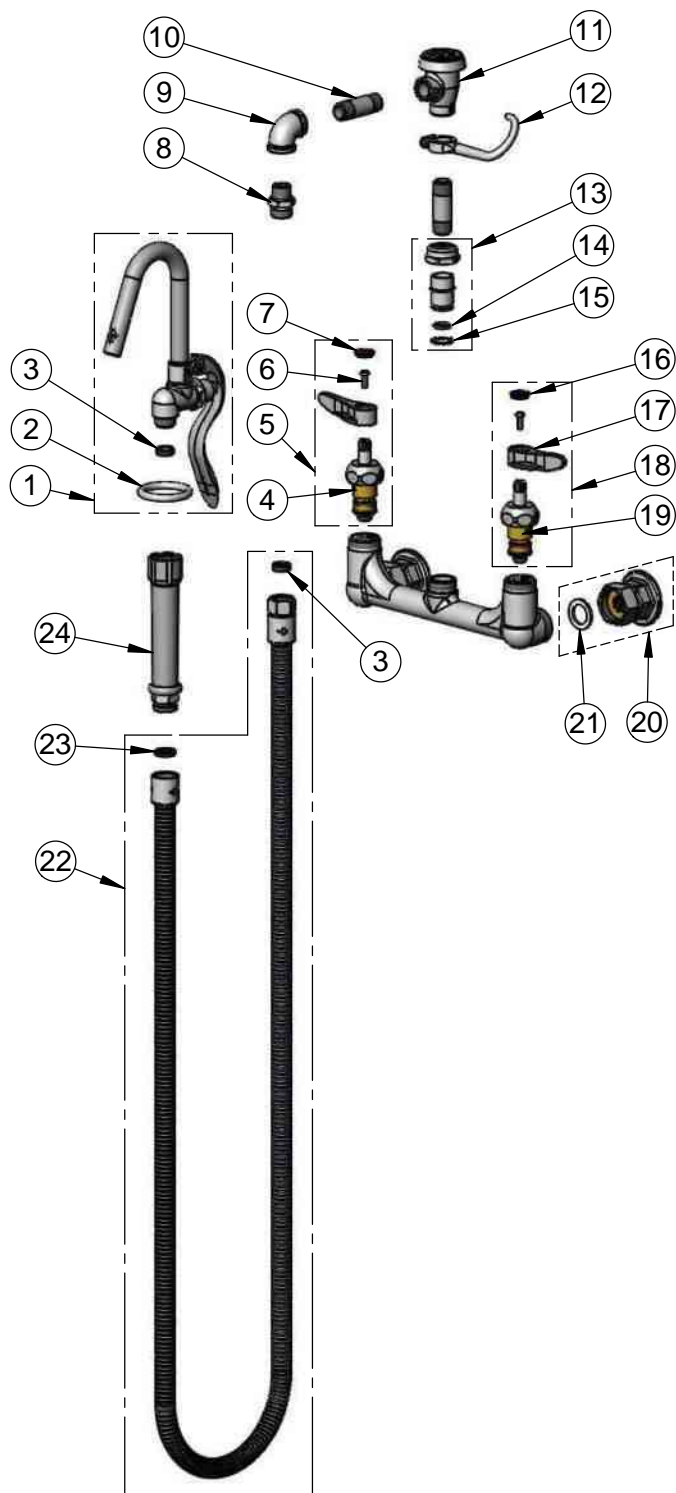
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Travelers Rest, SC 29690

Model No.

**B-0610-CR**

Item No.

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ITEM NO.	SALES NO.	DESCRIPTION
1	002851-40	Hook Nozzle Spray Valve
2	000907-45	Spray Valve Hold Down Ring
3	010476-45	#27 Washer
4	012394-25NS	Quarter-Turn Cerama Cartridge w/ Check Valve, RTC
5	012446-25NS	Quarter-Turn Cerama Cartridge w/ Check Valve, Handle, Red Index & Screw, RTC
6	000925-45	Lab Handle Screw
7	001193-19NS	Red Button Index, Press-in
8	053A	Adapter, 3/8" NPT Male
9	001355-40	Elbow, 3/8 NPT
10	000357-40	Nipple, 3/8" NPT x 2"
11	B-0968	3/8" NPT Vacuum Breaker
12	004R	Finger Hook
13	EZ-K	EasyInstall Kit
14	001065-45	O-ring
15	014200-45	Star Washer, Anti-Rotation
16	018506-19NS	Blue Button Index, Press-in
17	001638-45NS	Lever Handle (New Style)
18	012447-25NS	Quarter-Turn Cerama Cartridge w/ Check Valve, Handle, Blue Index & Screw, LTC
19	012395-25NS	Quarter-Turn Cerama Cartridge w/ Check Valve, LTC
20	00AA	1/2" NPT Female Eccentric Flange
21	001019-45	Coupling Nut Washer
22	B-0068-H2A	68" Flexible Stainless Steel Hose, Less Handle
23	001014-45	Washer, B-0100 Hose Barrel
24	002987-40	Grip Handle

**Product Specifications:**

Kettle & Pot Filler Wall Mount Faucet, Quarter-Turn Cerama Cartridges w/ Check Valves, Lever Handles, 3/8" NPT Vacuum Breaker, 68" Flexible Stainless Steel Hose, Hook Nozzle & 1/2" NPT Female Inlets

**Product Compliance:**

ASME A112.18.1 / CSA B125.1  
NSF 61 - Section 9  
NSF 372 (Low Lead Content)  
ASSE 1001 (VB)  
EPA Act 2005 Non-Compliant

Drawn: DMH | Checked: JRM | Approved: JHB | Date: 02/17/17 | Scale: NTS | Sheet: 2 of 2





***Submittal Sheet***

01/09/2023

**ITEM# 43 - SPARE NO.**

<Spare No.>



***Submittal Sheet***

01/09/2023

**ITEM# 44 - SPARE NO.**

<Spare No.>



***Submittal Sheet***

01/09/2023

**ITEM# 45 - SPARE NO.**

<Spare No.>



***Submittal Sheet***

01/09/2023

**ITEM# 46 - SPARE NO.**

<Spare No.>



***Submittal Sheet***

01/09/2023

**ITEM# 47 - SPARE NO.**

<Spare No.>



***Submittal Sheet***

01/09/2023

**ITEM# 48 - SPARE NO.**

<Spare No.>



***Submittal Sheet***

01/09/2023

**ITEM# 49 - SPARE NO.**

<Spare No.>



**Submittal Sheet**

01/09/2023

**ITEM# 50 - RANGE, 36", 6 OPEN BURNERS (1 EA REQ'D)**

Vulcan 36S-6BN

Endurance™ Restaurant Range, natural gas, 36", (6) 30,000 BTU burners, lift-off burner heads, standard oven, stainless steel front, sides, backriser, & lift-off high shelf, fully MIG welded chassis, 6" adjustable legs, 215,000 BTU, CSA, NSF

**ACCESSORIES**

Mfr	Qty	Model	Spec
Vulcan	1		1 year limited parts & labor warranty, standard
Vulcan	1		Stainless steel backriser & lift-off high shelf, standard
Vulcan	1	STUB4-XL36	4" Stub back, for 36" ranges, stainless steel
Vulcan	1	CASTERS-RR4	Casters, 5" (set of 4) (2 with locks)

**GAS**

	SIZE	MBTU	KW
1	3/4"	215.0	

**STEAM**

	INLET SIZE	RETURN SIZE	LB/HR	PSIG (min)	PSIG (max)
1					



## RESTAURANT RANGES

**VULCAN****ENDURANCE GAS RESTAURANT RANGE  
6 OPEN BURNERS  
36" WIDE GAS RANGE**

**Model 36S-6BN**  
(shown with optional casters)

**SPECIFICATIONS**

36" wide gas restaurant range, Vulcan Model No. 36S-6BN. Fully MIG welded aluminized steel frame for added durability. Stainless steel front, sides, backriser, highshelf and 6" adjustable legs. Extra deep crumb tray with welded corners. Six 30,000 BTU/hr. open top burners with lift-off burner heads. Energy saving flashtube open burner ignition system (one pilot for every two burners) shrouded for reliability. Heavy duty cast grates, easy lift-off 12" x 12½" in the front and 12" x 14½" in the back to better accommodate stock pots or large pans. Grates have a built in aeration bowl for greater efficiency. Burner knobs are cool to the touch, high temperature material. One oven: 35,000 BTU/hr. standard bakers depth ovens with porcelain oven bottom and door panel, measures 27"d x 26¾"w x 14"h. Oven thermostat adjusts from 250°F to 500°F with a low setting. Oven is supplied with two racks, two rack guide sets, and four rack positions. Oven door is heavy duty with an integrated door hinge/spring mechanism requiring no adjustment. ¾" rear gas connection and pressure regulator. Total input 215,000 BTU/hr.

**Exterior Dimensions:**

34"d x 36"w x 58"h on 6" adjustable legs

- 36S-6BN** 1 Standard Oven / Natural Gas
- 36S-6BP** 1 Standard Oven / Propane
- 36C-6BN** 1 Convection Oven / Natural Gas
- 36C-6BP** 1 Convection Oven / Propane

**STANDARD FEATURES**

- Fully MIG welded frame
- Stainless steel front, sides, backriser, lift-off high shelf
- 6" stainless steel adjustable legs
- Six open top burners, each burner is 30,000 BTU/hr. with lift-off burner heads
- Shrouded flash tube pilot system (one pilot per two burners)
- Heavy duty cast grates, easy lift-off 12" x 12½" in front and 12" x 14½" in the rear
- Extra deep pull out crumb tray with welded corners
- 35,000 BTU/hr. baker's depth standard oven cavity. Full size sheet pans fit side-to-side or front-to-back.
- Oven thermostat adjusts from 250°F to 500°F
- Two oven racks and four rack positions
- 35,000 BTU/hr. convection oven in place of standard oven, 24"d x 26¾"w x 13¾"h (115v - 1 phase blower motor 4 amp, 6' cord and plug), includes three oven racks. Full size sheet pans only fit side-to-side in convection oven. Convection oven motor requires field attachment.
- One year limited parts and labor warranty

**ACCESSORIES** (Packaged & Sold Separately)

- Extra oven rack with rack guides
- Casters (set of four)
- Leveling casters (set of four)
- Flanged feet (set of four)
- 10" stainless steel stub back
- Reinforced high shelf for mounting salamander broiler

**OPTIONS** (Factory Installed)

- Flame Safety device with manual spark ignition for all open top burners, thermostatic griddles and oven pilots
- Hot tops

**VULCAN**

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## RESTAURANT RANGES

# VULCAN

## ENDURANCE GAS RESTAURANT RANGE 6 OPEN BURNERS 36" WIDE GAS RANGE

### INSTALLATION INSTRUCTIONS

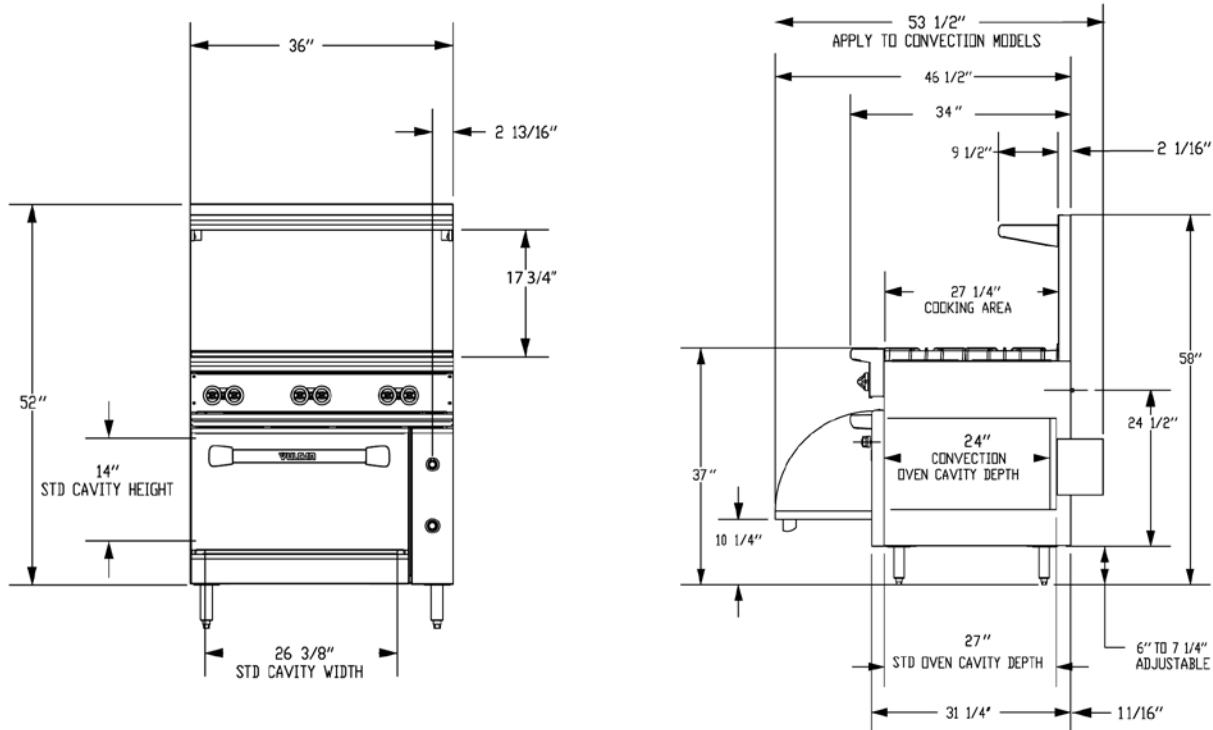
1. A pressure regulator sized for this unit is included. Natural gas 5.0" W.C., propane gas 10.0" W.C.
2. Gas line connecting to range must be  $\frac{3}{4}$ " or larger. If flexible connectors are used, the inside diameter must be  $\frac{3}{4}$ " or larger.
3. An adequate ventilation system is required for commercial cooking equipment. Information may be obtained by writing to the National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269, www.NFPA.org. When writing, refer to NFPA No. 96.
4. These units are manufactured for installation in accordance with ANSZ223.1A (latest edition), National Fuel Gas Code. Copies may be obtained from The American Gas Association, 400 N Capitol St. NW, Washington, DC 20001, www.AGA.org.

5. **Clearances**

	Rear	Sides
Combustible	6"	10"
Standard Oven Non-combustible	0"	0"
Convection Oven Non-combustible	Min. 4"	0"
6. For proper combustion, install equipment on adjustable legs or casters provided with unit.

**NOTE:** In line with its policy to continually improve its product, Vulcan reserves the right to change materials and specifications without notice.

**Specify type of gas when ordering.  
Specify altitude when above 2,000 feet.**



TOP CONFIGURATION	MODEL NUMBER	DESCRIPTION	TOTAL INPUT BTU / HR	SHIPPING WEIGHT LBS / KG
	<b>36S-6BN</b>	1 Standard Oven / 6 Burners / Natural Gas	215,000	520 / 236
	<b>36S-6BP</b>	1 Standard Oven / 6 Burners / Propane	215,000	520 / 236
	<b>36C-6BN</b>	1 Convection Oven / 6 Burners / Natural Gas	215,000	580 / 263
	<b>36C-6BP</b>	1 Convection Oven / 6 Burners / Propane	215,000	580 / 263

This appliance is manufactured for commercial use only and is not intended for home use.

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## Submittal Sheet

01/09/2023

### ITEM# 51 - GRIDDLE, GAS, COUNTERTOP (1 EA REQ'D)

Vulcan MSA60

Heavy Duty Griddle, countertop, gas, 60" W x 24" D cooking surface, 1" thick polished steel griddle plate, embedded mechanical snap action thermostat every 12", millivolt pilot safety, manual ignition, low profile, stainless steel front, sides, front grease trough, 6 qt. grease can, 4" back & tapered side splashes, 4" adjustable legs, 135,000 BTU, CSA Star, CSA Flame, NSF

#### ACCESSORIES

Mfr	Qty	Model	Spec
Vulcan	1		1 year limited parts & labor warranty, standard
Vulcan	1		Natural gas (specify elevation if over 2,000 ft.)
Vulcan	1	PLTRAIL-60	Plate Rail, 60" wide x 10-5/8" deep, stainless steel (NOTE: Not compatible with rear grease trough griddles)
Eagle Group	1	T3060SGS	Griddle/Equipment Stand, 60-3/8"W x 30-3/8"D x 25-1/4"H, 16/300 stainless steel top, 1-1/4"H up-turn on sides & rear, open base with stainless steel adjustable undershelf, 1000 lbs weight capacity, Uni-Lok® gusset system, (4) stainless steel legs with adjustable white metal feet, NSF
Eagle Group	1		NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.
Eagle Group	1	307107	Cutting Board, equipment-mounted, 60"W x 8"D, 1-1/4" thick laminated hardwood, 1" diameter stainless steel tubular supports integrally welded to adjustable stainless steel sleeve assembly, NSF
Eagle Group	1	CAH4-SB	Table Casters, set of (4), 5" diameter, (2) swivel & (2) swivel/brake, 200 lbs. capacity per caster, zinc with resilient tread, NSF

#### GAS

	SIZE	MBTU	KW
1	3/4"	135.0	

#### STEAM

	INLET SIZE	RETURN SIZE	LB/HR	PSIG (min)	PSIG (max)
1					

## GRIDDLES &amp; BROILERS

**VULCAN****MSA SERIES  
HEAVY DUTY GAS GRIDDLES**

Model MSA48

**SPECIFICATIONS**

Low profile heavy duty gas griddle, Vulcan Model No. \_\_\_\_\_. Stainless steel front, sides and front top ledge. Fully welded stainless and aluminized steel body frame. 11" low profile cooking height on 4" legs. 1" thick polished steel griddle plate with 12 gage, 4" stainless steel back and tapered side splashes. Grease chute is fully welded to stop grease migration. One 27,000 BTU/hr. "U" shaped aluminized steel burner and mechanical snap action thermostat for each 12" of griddle width. Chrome thermostat knob guards. Temperature adjusts from 200° to 550°F. One pilot safety for every two burners. 3½" wide stainless steel grease trough. ¾" rear gas connection and gas pressure regulator.

**Exterior Dimensions:**

\_\_\_\_\_ "w x 33" d x 15½" h on 4" legs.

CSA design certified. NSF listed.

**SPECIFY TYPE OF GAS WHEN ORDERING.  
SPECIFY ALTITUDE WHEN ABOVE 3,999 FT.**

- MSA24** 24" w x 24" d griddle plate
- MSA36** 36" w x 24" d griddle plate
- MSA48** 48" w x 24" d griddle plate
- MSA60** 60" w x 24" d griddle plate
- MSA72** 72" w x 24" d griddle plate

**STANDARD FEATURES**

- Stainless steel front, sides and front top ledge with "Cool Bullnose" design.
- Fully welded stainless and aluminized steel chassis frame.
- 11" low profile cooking height on 4" adjustable legs.
- 1" thick polished steel griddle plate with 12 gauge, 4" stainless steel back and tapered side splashes.
- Spatula wide 3½" grease gutter and chute is fully welded for easier cleaning and to stop grease migration.
- One 27,000 BTU/hr. "U" shaped aluminized steel burner for every 12" of griddle width.
- One embedded snap action thermostat per burner with temperature adjust from 200°F to 550°F on Steel or Chrome plate. Temperature adjusts from 200°F to 450°F on Rapid Recovery™ plate.
- Large 6 quart stainless steel grease drawer (2 drawers on 60" and 72" models).
- Heavy duty chromed thermostat knob guards.
- One pilot safety valve for every two burners. Safety will completely shut off gas to pilot and burners if pilot extinguishes.
- Manual ignition.
- Bottom heat shields.
- ¾" rear gas connection and gas pressure regulator.
- One year limited parts and labor warranty.

**OPTIONAL FEATURES**

- Full or partially grooved griddle plate (steel or chrome plate only).
- Rapid Recovery™ griddle plate (200-450°F controls, 48" maximum length).
- Hexavalent chrome plated cooking surface.
- 30" deep plate (steel plate only).
- Stainless steel stand with marine edges and casters.
- Cutting board, condiment rail, plate rail and banking strip accessories.

**VULCAN**

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GRIDDLES & BROILERS



MSA SERIES  
HEAVY DUTY GAS GRIDDLES

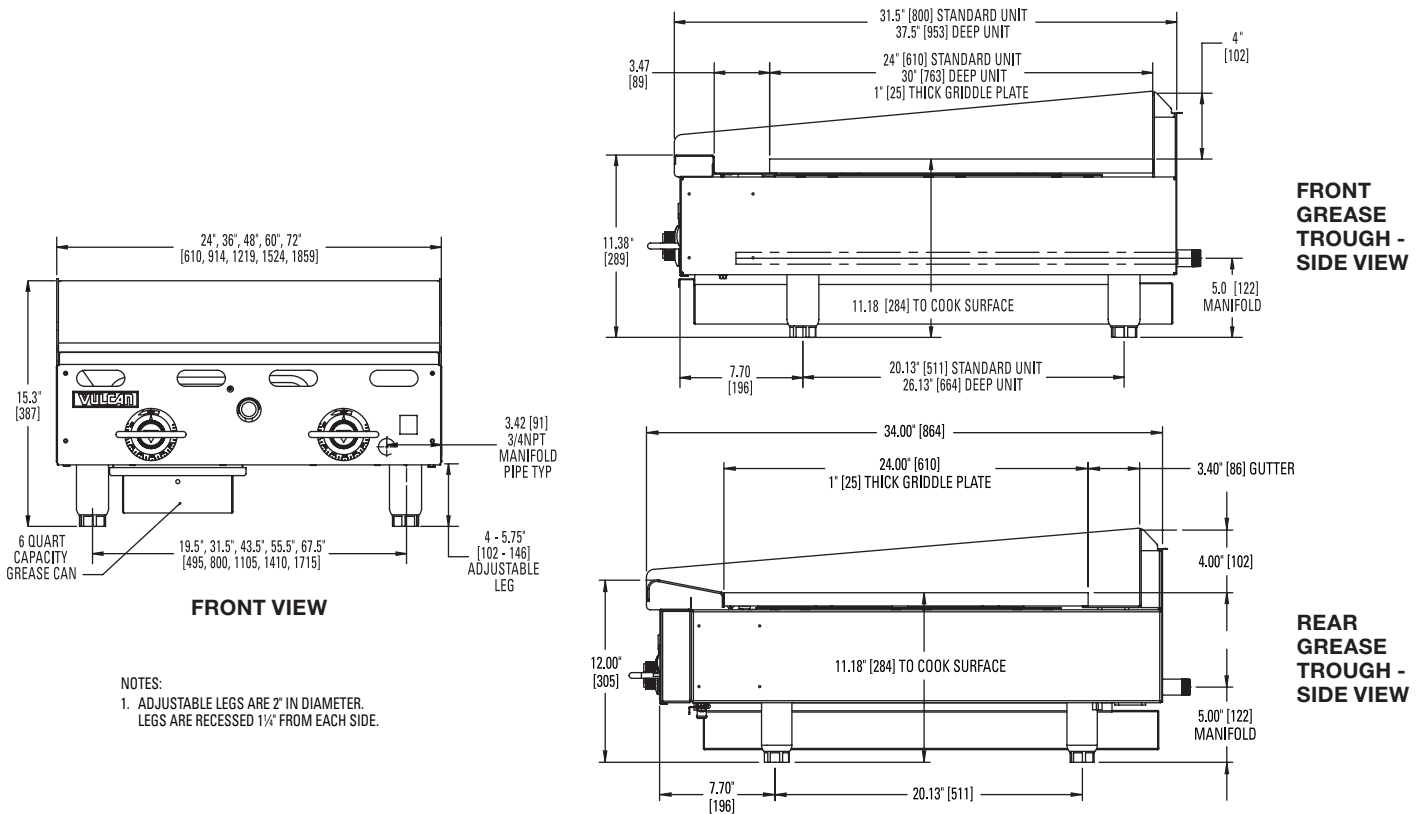
INSTALLATION INSTRUCTIONS

1. A gas pressure regulator supplied with the unit must be installed;
  - Natural Gas 4.0" (102 mm) W.C.
  - Propane Gas 10.0" (254 mm) W.C.
2. All models require a 6" (152 mm) clearance at both sides and rear adjacent to combustible and 0" from non-combustible constructions. All models require a 4" (102mm) bottom clearance and must be installed with minimum 4" legs.
3. These units are manufactured for installation in accordance with ANSI/NFPA-70, National Electrical code.
 

An adequate ventilation system is required for Commercial Cooking Equipment (NFPA No. 96). Information may be obtained by writing to the National Fire Protection Association, Batterymarch Park, Quincy, MA 02169.

4. These units are manufactured for installation in accordance with National Fuel Gas Code, ANSI-Z223.1/NFPA #54 (latest edition). Copies may be obtained from The American Gas Association, Accredited Standards Committee Z223 @ 400 N. Capital St. NW, Washington, DC 20001, or the Secretary Standards Council, NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471.
 

**NOTE: In The Commonwealth of Massachusetts**  
All gas appliances vented through ventilation hood or exhaust system equipped with a damper or with a power means of exhaust shall comply with 248 CMR.
5. This appliance is manufactured for commercial installation only and is not intended for home use.



MODEL	WIDTH	DEPTH	OVERALL HEIGHT*	WORKING HEIGHT*	NO. OF BURNERS	TOTAL BTU/HR.	NO. OF DRAWERS	APPROX. SHIP. WT.
MSA24	24"	31½"	15¼"	11⅛"	2	54,000	1	285 lbs./129 kg.
MSA36	36"	31½"	15¼"	11⅛"	3	81,000	1	400 lbs./181 kg.
MSA48	48"	31½"	15¼"	11⅛"	4	108,000	1	480 lbs./218 kg.
MSA60	60"	31½"	15¼"	11⅛"	5	135,000	2	650 lbs./295 kg.
MSA72	72"	31½"	15¼"	11⅛"	6	162,000	2	790 lbs./358 kg.

\*These are nominal dimensions and can vary by +1.75" with adjustable legs.



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NOTE: In line with its policy to continually improve its products, Vulcan reserves the right to change materials and specifications without notice.

# VULCAN

 Item# \_\_\_\_\_  
 C.S.I. Section 11420

## ACCESSORIES

### MSA AND 900RX HEAVY DUTY GAS GRIDDLES



**GRIDDLE PLATE RAIL**

- CUTTING BOARD
- CONDIMENT RAIL
- PLATE RAIL
- TOWEL BAR
- LEG OPTIONS
- BANKING STRIP
- GROOVED GRIDDLE SCRAPER
- KNOB GUARDS

#### STANDARD FEATURES

- Stainless steel construction.
- Welded and smooth blended edges.
- Line matched to VACB charbroiler and VHP hotplate accessories.
- Cutting board accessory features stainless steel frame with removable board inserts. Inserts are 1" thick X 7" wide, Sani-TUFF® rubber NSF listed boards.
- Condiment rails will accommodate up to the following amounts of 1/6 size containers:
  - 24" model – 3
  - 36" model – 4
  - 48" model – 6
  - 60" model – 8
  - 72" model – 9
- Plate rails feature a full 10<sup>5</sup>/<sub>8</sub>" deep stainless steel shelf.
- Towel bar accessory offers convenient location to hang towels and acts as a "belly bar" to prevent operator contact with a hot griddle.
- Adjustable bullet foot legs available in 6", 8", 10" and 12" lengths.
- Adjustable flange foot legs available in 4" and 6" lengths.
- Banking strip connects like side splashes together.
- Grooved griddle scraper has heavy duty handle and scraping head that matches grooved plate contour of MSA and 900RX series griddles.
- Knob guards protect thermostat knobs from accidental damage.(one for each thermostat)
- One year limited parts and labor warranty.



**GRIDDLE CUTTING BOARD    CHARBROILER CONDIMENT RAIL    HOTPLATE PLATE RAIL**

#### OPTIONS

- Product variations available. See your sales representative for product variance requests.

**SPECIFY GRIDDLE SIZE WHEN ORDERING.**

**VULCAN-HART COMPANY, P.O. BOX 696, LOUISVILLE, KY 40201, TEL. 1-800-814-2028  
 502-778-2791 QUOTE & ORDER FAX: 1-800-444-0602**

# VULCAN



A2780  
 ISO9001  
 Vulcan-Hart Co.

**ACCESSORIES: MSA And 900RX Heavy Duty Gas Griddles**

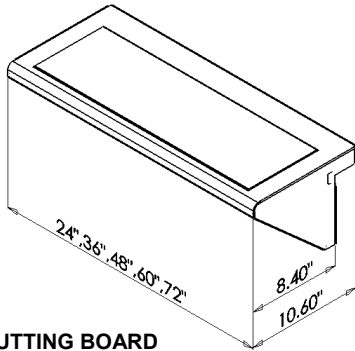




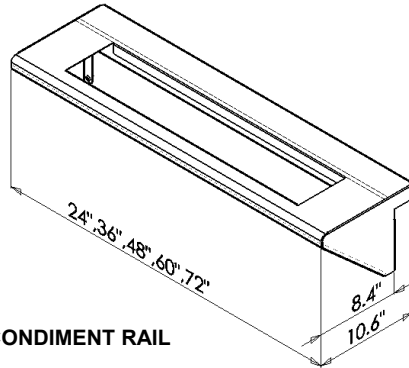
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C.S.I. Section 11420

# ACCESSORIES

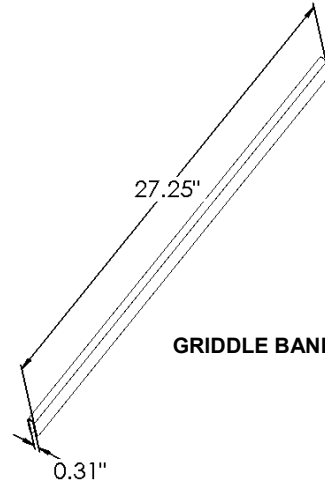
## MSA AND 900RX HEAVY DUTY GAS GRIDDLES



CUTTING BOARD



CONDIMENT RAIL



GRIDDLE BANKING STRIP

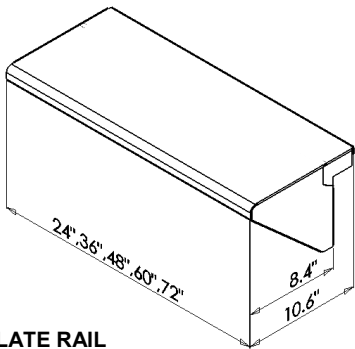
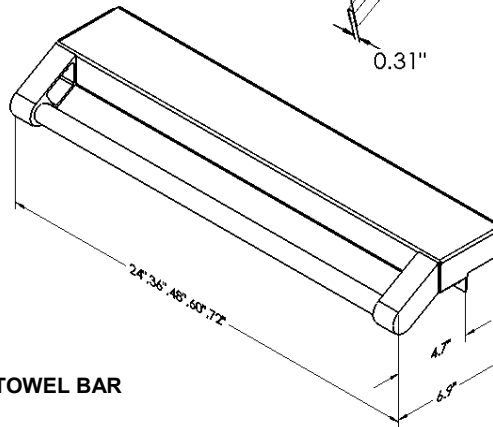
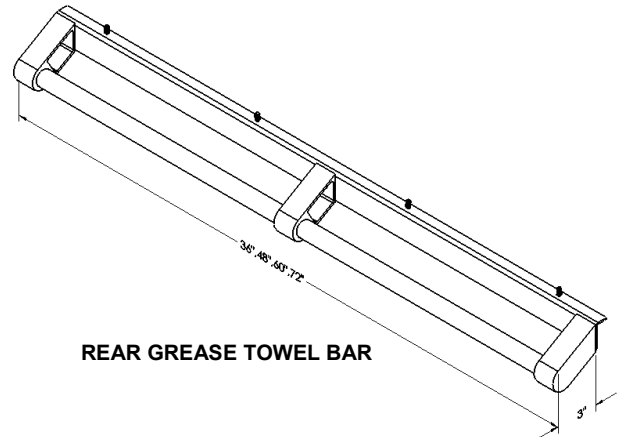


PLATE RAIL



TOWEL BAR

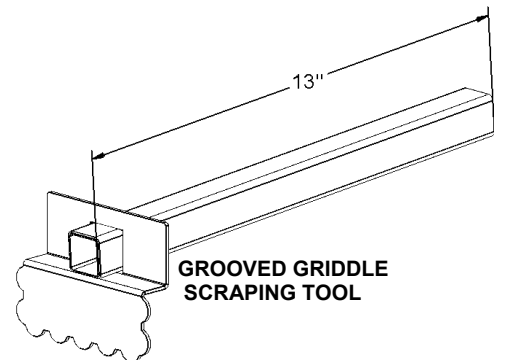


REAR GREASE TOWEL BAR

SIZE	ACCESSORY CODES				
	CUTTING BOARD	CONDIMENT RAIL	PLATE RAIL	TOWEL BAR	REAR GREASE TOWEL BAR
24	CUTBD-24	CONRAIL-24	PLTRAIL-24	TOWELBR-24	N/A
36	CUTBD-36	CONRAIL-36	PLTRAIL-36	TOWELBR-36	TOWELBR-36RG
48	CUTBD-48*	CONRAIL-48	PLTRAIL-48	TOWELBR-48	TOWELBR-48RG
60	CUTBD-60*	CONRAIL-60	PLTRAIL-60	TOWELBR-60	TOWELBR-60RG
72	CUTBD-72*	CONRAIL-72	PLTRAIL-72	TOWELBR-72	TOWELBR-72RG

\*Two section board

DESCRIPTION	ACCESSORY CODE
Flex gas hose for gas griddles (3/4" x 4 ft.)	3/4QDH-4FT
Wire knob guard (order one per thermostat)	WGUARD-KNOB
4" legs, flanged foot, 1.75" adjust, cook height 11.38"-13.13", Qty (4)	LEGS-GRD4F
6" legs, (5.63" nom.) 1.75" adjust, cook height 13.00"-14.75", Qty (4)	LEGS-GRD6
8" legs, 1.75" adjust, cook height 15.38"-17.13", Qty (4)	LEGS-GRD8
10" legs, 1.75" adjust, cook height 17.38"-19.13", Qty (4)	LEGS-GRD10
12" legs, (11.25" nom.) 1.75" adjust, cook height 18.63"-20.38", Qty (4)	LEGS-GRD12
6" flanged leg Qty (4)	LEGS-6FLG
Griddle banking strip (connects side splashes of two units)	BANKING-STRIP
Grooved griddle scraping tool	SCRAPER-GROOVE



GROOVED GRIDDLE SCRAPING TOOL

**NOTE:** In line with its policy to continually improve its products, Vulcan-Hart Company reserves the right to change materials and specifications without notice.

**VULCAN-HART COMPANY, P.O. BOX 696, LOUISVILLE, KY 40201, TEL. 1-800-814-2028  
502-778-2791 QUOTE & ORDER FAX: 1-800-444-0602**



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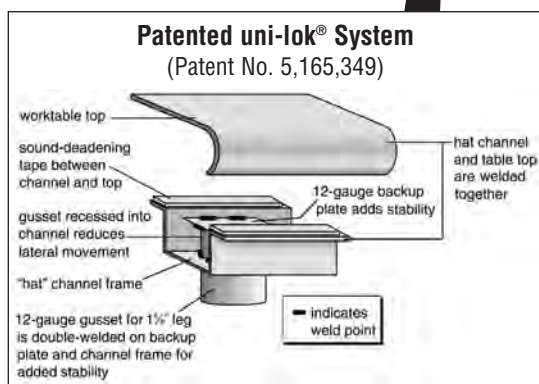
## Specification Sheet

### Short Form Specifications

Eagle Griddle/Equipment Stand, model \_\_\_\_\_.  
16 gauge type 300 stainless steel top with 1¼" upturn on rear and sides. Constructed with uni-lok® patented gusset system with the gussets recessed into the hat channels to reduce lateral movement. Heavy gauge (galvanized, stainless steel) adjustable undershelf, 1½"-diameter galvanized tubular legs with white metal adjustable bullet feet. Note: Units 72" and longer furnished with six legs.



unit shown with optional  
hardwood cutting board



### Options / Accessories\*

- Hardwood cutting board
- Stainless steel plate shelf
- Casters
- Stainless steel bullet feet

\* Optional Worktable Stabilizer Bars (EG10.59) do not work with Griddle/Equipment Stands.

### EAGLE GROUP

100 Industrial Boulevard, Clayton, DE 19938-9905 USA

Phone: 302-653-3000 • Fax: 302-653-2065

www.eaglegrp.com

Foodservice Division: Phone 800-441-8440

MHC/Retail Display Divisions: Phone 800-637-5100

For custom configuration or fabrication needs, contact our SpecFAB® Division.

Phone: 302-653-3000 • Fax: 302-653-2065 • e-mail: quotes@eaglegrp.com

Spec sheets available for viewing, printing or downloading from our online literature library at [www.eaglegrp.com](http://www.eaglegrp.com)

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Item No.: \_\_\_\_\_  
Project No.: \_\_\_\_\_  
S.I.S. No.: \_\_\_\_\_

## Griddle/Equipment Stands

### MODELS:

- |                                   |                                   |                                   |                                  |
|-----------------------------------|-----------------------------------|-----------------------------------|----------------------------------|
| <input type="checkbox"/> T2424GS  | <input type="checkbox"/> T2484SGS | <input type="checkbox"/> T3072GS  | <input type="checkbox"/> 307109  |
| <input type="checkbox"/> T2424SGS | <input type="checkbox"/> T2496GS  | <input type="checkbox"/> T3072SGS | <input type="checkbox"/> 307110  |
| <input type="checkbox"/> T2436GS  | <input type="checkbox"/> T2496SGS | <input type="checkbox"/> T3084GS  | <input type="checkbox"/> APS1    |
| <input type="checkbox"/> T2436SGS | <input type="checkbox"/> T3024GS  | <input type="checkbox"/> T3084SGS | <input type="checkbox"/> APS2    |
| <input type="checkbox"/> T2448GS  | <input type="checkbox"/> T3024SGS | <input type="checkbox"/> T3096GS  | <input type="checkbox"/> APS3    |
| <input type="checkbox"/> T2448SGS | <input type="checkbox"/> T3036GS  | <input type="checkbox"/> T3096SGS | <input type="checkbox"/> APS4    |
| <input type="checkbox"/> T2460GS  | <input type="checkbox"/> T3036SGS | <input type="checkbox"/> 313970   | <input type="checkbox"/> APS5    |
| <input type="checkbox"/> T2460SGS | <input type="checkbox"/> T3048GS  | <input type="checkbox"/> 307105   | <input type="checkbox"/> APS6    |
| <input type="checkbox"/> T2472GS  | <input type="checkbox"/> T3048SGS | <input type="checkbox"/> 307106   | <input type="checkbox"/> APS7    |
| <input type="checkbox"/> T2472SGS | <input type="checkbox"/> T3060GS  | <input type="checkbox"/> 307107   | <input type="checkbox"/> APS8    |
| <input type="checkbox"/> T2484GS  | <input type="checkbox"/> T3060SGS | <input type="checkbox"/> 307108   | <input type="checkbox"/> CAH4-SB |
|                                   |                                   |                                   | <input type="checkbox"/> CAH6-SB |

### Tabletop

- Patented uni-lok® gusset system (patent #5,165,349): gussets are recessed into hat channel, reducing lateral movement.
- Highly-polished 16 gauge type 300 stainless steel top with 1¼" (32mm) upturn on rear and both ends.

### Adjustable Undershelf

- Heavy gauge galvanized or stainless steel, with gusset welded on each corner.

### Legs

- Galvanized or stainless steel.
- 1½" (41mm)-diameter.
- Adjustable white metal feet.

### Optional Hardwood Cutting Board

- Laminated, 1¼" (32mm)-thick, full length of stand, 8" (203mm)-wide.
- Complete with 1" (25mm) OD stainless steel tubular supports integrally welded to adjustable stainless steel sleeve assembly.
- Board adjustment range is 8½" (216mm) at lowest point to maximum of 11" (279mm).

### Optional Plate Shelf

- Full length of stand, 8" (203mm)-wide.
- 18 gauge stainless steel.
- Adjustable height.
- Must be ordered in conjunction with cutting board.

### Certifications / Approvals



### AUTOQUOTES



EG10.27 Rev. 05/15

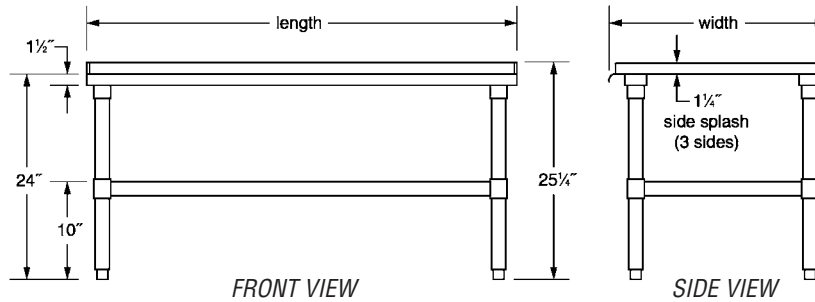




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 Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

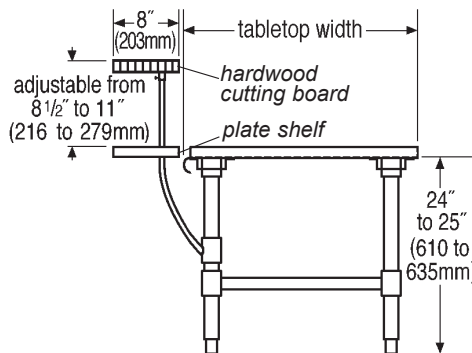
## Griddle/Equipment Stands



galvanized legs and undershelf model #	stainless legs and undershelf model #	# of legs	tabletop dimensions				weight capacities				weight	
			width in.	width mm	length in.	length mm	bullet lbs.	bullet kg	opt'l casters lbs.	opt'l casters kg	lbs.	kg
T2424GS	T2424SGS	4	24 3/8"	619	24 3/8"	619	1000	453.6	600	272.2	48	21.8
T2436GS	T2436SGS	4	24 3/8"	619	36 3/8"	924	1000	453.6	600	272.2	54	24.5
T2448GS	T2448SGS	4	24 3/8"	619	48 3/8"	1229	1000	453.6	600	272.2	62	28.1
T2460GS	T2460SGS	4	24 3/8"	619	60 3/8"	1534	1000	453.6	600	272.2	74	33.6
T2472GS	T2472SGS	6	24 3/8"	619	72 3/8"	1838	1500	680.4	800	362.9	86	39.0
T2484GS	T2484SGS	6	24 3/8"	619	84 3/8"	2143	1500	680.4	800	362.9	99	44.9
T2496GS	T2496SGS	6	24 3/8"	619	96 3/8"	2448	1500	680.4	800	362.9	120	54.4
T3024GS	T3024SGS	4	30 3/8"	772	24 3/8"	619	1000	453.6	600	272.2	48	21.8
T3036GS	T3036SGS	4	30 3/8"	772	36 3/8"	914	1000	453.6	600	272.2	55	24.9
T3048GS	T3048SGS	4	30 3/8"	772	48 3/8"	1229	1000	453.6	600	272.2	71	32.2
T3060GS	T3060SGS	4	30 3/8"	772	60 3/8"	1534	1000	453.6	600	272.2	83	37.6
T3072GS	T3072SGS	6	30 3/8"	772	72 3/8"	1838	1500	680.4	800	362.9	96	43.6
T3084GS	T3084SGS	6	30 3/8"	772	84 3/8"	2143	1500	680.4	800	362.9	112	50.8
T3096GS	T3096SGS	6	30 3/8"	772	96 3/8"	2448	1500	680.4	800	362.9	125	56.7

### Optional Hardwood Cutting Board

model #	width in.	width mm	length in.	length mm	weight lbs.	weight kg
313970	8"	203	24"	610	12	5.4
307105	8"	203	36"	914	16	7.3
307106	8"	203	48"	1219	21	9.5
307107	8"	203	60"	1524	26	11.8
307108	8"	203	72"	1829	31	14.1
307109	8"	203	84"	2134	39	17.6
307110	8"	203	96"	2438	46	20.9



dimensions of unit with optional hardwood cutting board and plate shelf



casters

### Optional Zinc Swivel Casters

5" (127mm)-diameter. 200 lb. (90.7 kg) weight capacity per caster. Heavy duty. Resilient tread.

model #	description
CAH4-SB	set of 4 (2 w/brake)
CAH6-SB	set of 6 (3 w/brake)

### EAGLE GROUP

100 Industrial Boulevard, Clayton, DE 19938-9905 USA

Phone: 302-653-3000 • Fax: 302-653-2065

www.eaglegrp.com

Foodservice Division: Phone 800-441-8440

MHC/Retail Display Divisions: Phone 800-637-5100

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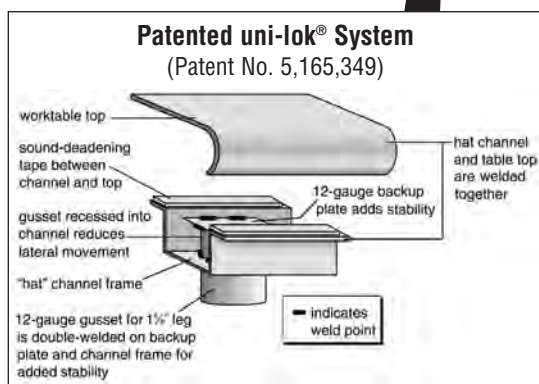
## Specification Sheet

### Short Form Specifications

Eagle Griddle/Equipment Stand, model \_\_\_\_\_.  
Top to be 16/304 stainless steel with 1/4" upturn on rear and sides. Constructed with uni-lok® patented gusset system with the gussets recessed into the hat channels to reduce lateral movement. Heavy gauge (galvanized, stainless steel) adjustable undershelf, 1/2"-diameter galvanized tubular legs with white metal adjustable bullet feet. Note: Units 72" and longer furnished with six legs.



unit shown with optional  
hardwood cutting board



### Options / Accessories\*

- Hardwood cutting board
- Stainless steel plate shelf
- Casters
- Stainless steel bullet feet

\* Optional Worktable Stabilizer Bars (EG10.59) do not work with Griddle/Equipment Stands.

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Item No.: \_\_\_\_\_  
Project No.: \_\_\_\_\_  
S.I.S. No.: \_\_\_\_\_

## Griddle/Equipment Stands

### MODELS:

- |                                   |                                   |                                   |                                  |
|-----------------------------------|-----------------------------------|-----------------------------------|----------------------------------|
| <input type="checkbox"/> T2424GS  | <input type="checkbox"/> T2484SGS | <input type="checkbox"/> T3072GS  | <input type="checkbox"/> 307109  |
| <input type="checkbox"/> T2424SGS | <input type="checkbox"/> T2496GS  | <input type="checkbox"/> T3072SGS | <input type="checkbox"/> 307110  |
| <input type="checkbox"/> T2436GS  | <input type="checkbox"/> T2496SGS | <input type="checkbox"/> T3084GS  | <input type="checkbox"/> APS1    |
| <input type="checkbox"/> T2436SGS | <input type="checkbox"/> T3024GS  | <input type="checkbox"/> T3084SGS | <input type="checkbox"/> APS2    |
| <input type="checkbox"/> T2448GS  | <input type="checkbox"/> T3024SGS | <input type="checkbox"/> T3096GS  | <input type="checkbox"/> APS3    |
| <input type="checkbox"/> T2448SGS | <input type="checkbox"/> T3036GS  | <input type="checkbox"/> T3096SGS | <input type="checkbox"/> APS4    |
| <input type="checkbox"/> T2460GS  | <input type="checkbox"/> T3036SGS | <input type="checkbox"/> 313970   | <input type="checkbox"/> APS5    |
| <input type="checkbox"/> T2460SGS | <input type="checkbox"/> T3048GS  | <input type="checkbox"/> 307105   | <input type="checkbox"/> APS6    |
| <input type="checkbox"/> T2472GS  | <input type="checkbox"/> T3048SGS | <input type="checkbox"/> 307106   | <input type="checkbox"/> APS7    |
| <input type="checkbox"/> T2472SGS | <input type="checkbox"/> T3060GS  | <input type="checkbox"/> 307107   | <input type="checkbox"/> APS8    |
| <input type="checkbox"/> T2484GS  | <input type="checkbox"/> T3060SGS | <input type="checkbox"/> 307108   | <input type="checkbox"/> CAH4-SB |
|                                   |                                   |                                   | <input type="checkbox"/> CAH6-SB |

### Tabletop

- Patented uni-lok® gusset system (patent #5,165,349): gussets are recessed into hat channel, reducing lateral movement.
- Highly-polished 16 gauge type 304 stainless steel top with 1/4" (32mm) upturn on rear and both ends.

### Adjustable Undershelf

- Heavy gauge galvanized or stainless steel, with gusset welded on each corner.

### Legs

- Galvanized or stainless steel.
- 1 1/2" (41mm)-diameter.
- Adjustable white metal feet.

### Optional Hardwood Cutting Board

- Laminated, 1/4" (32mm)-thick, full length of stand, 8" (203mm)-wide.
- Complete with 1" (25mm) OD stainless steel tubular supports integrally welded to adjustable stainless steel sleeve assembly.
- Board adjustment range is 8 1/2" (216mm) at lowest point to maximum of 11" (279mm).

### Optional Plate Shelf

- Full length of stand, 8" (203mm)-wide.
- 18 gauge stainless steel.
- Adjustable height.
- Must be ordered in conjunction with cutting board.

### Certifications / Approvals



### AUTOQUOTES



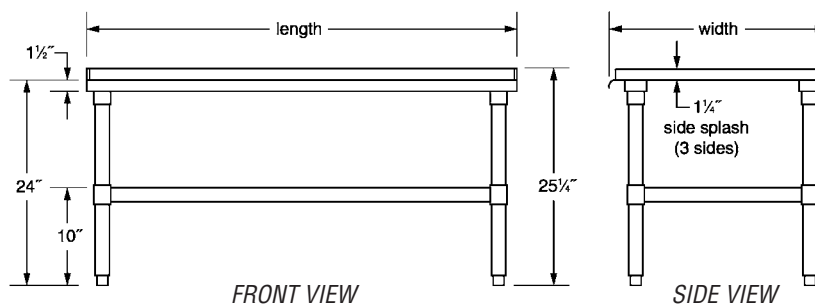
EG10.27 Rev. 11/14



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 Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

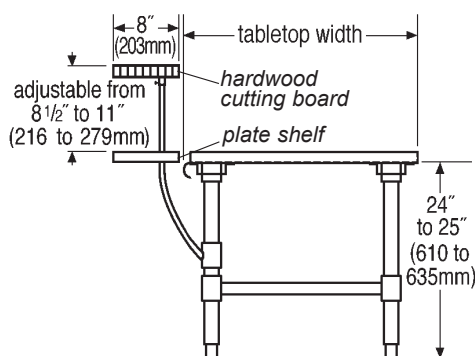
## Griddle/Equipment Stands



galvanized legs and undershelf model #	stainless legs and undershelf model #	# of legs	tabletop dimensions				weight capacities				weight	
			width in.	width mm	length in.	length mm	bullet lbs.	bullet kg	opt'l casters lbs.	opt'l casters kg	lbs.	kg
T2424GS	T2424SGS	4	24 3/8"	619	24 3/8"	619	1000	453.6	600	272.2	48	21.8
T2436GS	T2436SGS	4	24 3/8"	619	36 3/8"	924	1000	453.6	600	272.2	54	24.5
T2448GS	T2448SGS	4	24 3/8"	619	48 3/8"	1229	1000	453.6	600	272.2	62	28.1
T2460GS	T2460SGS	4	24 3/8"	619	60 3/8"	1534	1000	453.6	600	272.2	74	33.6
T2472GS	T2472SGS	6	24 3/8"	619	72 3/8"	1838	1500	680.4	800	362.9	86	39.0
T2484GS	T2484SGS	6	24 3/8"	619	84 3/8"	2143	1500	680.4	800	362.9	99	44.9
T2496GS	T2496SGS	6	24 3/8"	619	96 3/8"	2448	1500	680.4	800	362.9	120	54.4
T3024GS	T3024SGS	4	30 3/8"	772	24 3/8"	619	1000	453.6	600	272.2	48	21.8
T3036GS	T3036SGS	4	30 3/8"	772	36 3/8"	914	1000	453.6	600	272.2	55	24.9
T3048GS	T3048SGS	4	30 3/8"	772	48 3/8"	1229	1000	453.6	600	272.2	71	32.2
T3060GS	T3060SGS	4	30 3/8"	772	60 3/8"	1534	1000	453.6	600	272.2	83	37.6
T3072GS	T3072SGS	6	30 3/8"	772	72 3/8"	1838	1500	680.4	800	362.9	96	43.6
T3084GS	T3084SGS	6	30 3/8"	772	84 3/8"	2143	1500	680.4	800	362.9	112	50.8
T3096GS	T3096SGS	6	30 3/8"	772	96 3/8"	2448	1500	680.4	800	362.9	125	56.7

### Optional Hardwood Cutting Board

model #	width in.	width mm	length in.	length mm	weight lbs.	weight kg
313970	8"	203	24"	610	12	5.4
307105	8"	203	36"	914	16	7.3
307106	8"	203	48"	1219	21	9.5
307107	8"	203	60"	1524	26	11.8
307108	8"	203	72"	1829	31	14.1
307109	8"	203	84"	2134	39	17.6
307110	8"	203	96"	2438	46	20.9



dimensions of unit with optional hardwood cutting board and plate shelf



casters

### Optional Plate Shelf

model #	width in.	width mm	length in.	length mm	weight lbs.	weight kg
APS2	8"	203	24"	610	5	2.3
APS3	8"	203	36"	914	6	2.7
APS4	8"	203	48"	1219	7	3.2
APS5	8"	203	60"	1524	11	5.0
APS6	8"	203	72"	1829	13	5.8
APS7	8"	203	84"	2134	16	7.3
APS8	8"	203	96"	2438	20	9.0

### Optional Zinc Swivel Casters

5" (127mm)-diameter. 200 lb. (90.7 kg) weight capacity per caster. Heavy duty. Resilient tread.

model #	description
CAH4-SB	set of 4 (2 w/brake)
CAH6-SB	set of 6 (3 w/brake)

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## Submittal Sheet

01/09/2023

### ITEM# 52 - COMBI OVEN, GAS (1 EA REQ'D)

RATIONAL ICP 20-FULL NG 208/240V 1 PH (LM100GG)

(CG1GRRRA.0000245 - NG - 208/240V) iCombi Pro® 20-Full Size Combi Oven, natural gas, (20) 18" x 26" sheet pan or (40) 12" x 20" steam pan or (20) 2/1 GN pan capacity, mobile oven rack & (10) stainless steel grids included, intelligent cooking system with (4) assistants; iDensityControl, iCookingSuite, iProductionManager, & iCareSystem, (6) operating modes, (5) cooking methods, (3) manual operating modes, 85° to 572°F temperature range, quick clean, care control, eco mode, 6-point core temperature probe, retractable hand shower, Ethernet interface, Wi-Fi enabled, includes (1) bucket of Active Green Cleaner & (1) bucket of Care Tabs, 303,500 BTU, 208/240v/60/1-ph, 6 ft. cord, 2.2 kW, IPX5, cCSAus, NSF, ENERGY STAR®

### ACCESSORIES

Mfr	Qty	Model	Spec
RATIONAL	1		NOTE: All discounts subject to approval by manufacturer
RATIONAL	1		2 years parts and labor, 5 years steam generator warranty
RATIONAL	1	CAP	Chef Assistance Program, a RATIONAL certified Chef conducts 4 hours/location specialized application training with personnel, no charge

### ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	208/240	60	1	Cord & Plug		6-50P		2.2			

### GAS

	SIZE	MBTU	KW
1		303.5	

### STEAM

	INLET SIZE	RETURN SIZE	LB/HR	PSIG (min)	PSIG (max)
1					

### WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1				3/4"					

### WASTE

	INDIRECT SIZE	DIRECT SIZE
1	2"	



# Datasheet

## iCombi® Pro 20-full size E/G



### Description

Intelligent, connectable cooking system with the operating modes poultry, meat, fish, egg dishes/desserts, side dishes/vegetables, baked goods and finishing as well as the cooking methods roasting, cooking, baking and grilling.

- > Combi steamer as per DIN 18866 (in manual mode).
- > For most cooking processes used in commercial kitchens.
- > For using steam and convection, individually, one after the other, or combined.

Ventilation approvals: The electrical appliance conforms to the EPA 202 test in accordance with ANSI/NFPA 96 "Ventilation Control and Fire Protection of Commercial Cooking Operations" Refer to UL Listing KNLZ.E148536 (America) or KNLZ7.E148536 (Canada).

The following intelligent assistants are available:

### Intelligent assistant

iDensityControl  iProductionManager  iCookingSuite  iCareSystem 

#### iDensityControl

iDensityControl is the iCombi Pro's intelligent climate management. The interaction among intelligent sensors, a high-performance heating system and fresh steam generator, and active dehumidification ensures that the right cooking cabinet climate is always available. Intelligent air circulation ensures the best possible energy input into the food. Consequently, this ensures extraordinary productivity while maintaining high levels of food quality, even cooking and minimum energy consumption.

#### iCookingSuite

The iCookingSuite is the iCombi Pro's cooking intelligence. The user starts by selecting the right cooking path for the food, choosing from among 6 operating modes and / or 5 cooking methods. Users also specify the desired cooking result. The unit suggests settings for browning and degree of doneness. Intelligent sensors detect the size, quantity and condition of the food. While the cooking path is in progress, the system adjusts key parameters like cooking cabinet temperature, airspeed, and cooking time accurately to the second. The selected desired results are achieved, yielding the best possible quality in the shortest possible time. It is possible to optionally influence the cooking sequence and adapt the cooking result. Users can change to iProductionManager or manual mode at any time. Thanks to iCookingSuite you can simply save time, raw materials, and energy while maintaining a standardized food quality without having to check the procedure.

#### iProductionManager

iProductionManager intelligently and flexibly organizes the production process. This includes which products can be prepared together on different trays, the ideal sequence of dishes, and monitoring the cooking sequence. iProductionManager supports users with prompts to load or unload dishes. Depending on kitchen processes you can freely position orders (up to two per level) or schedule them on the basis of a certain target time. iProductionManager arranges the sequence of dishes accordingly and automatically specifies the correct settings. Users decide whether dishes are cooked based on optimum energy consumption or a certain target time. Simple monitoring activities are no longer required, saving you working time and energy.

#### iCareSystem

The iCareSystem is the intelligent iCombi Pro cleaning and descaling system. It recommends the amount of chemicals and ideal cleaning stage from the nine available programs based on usage and any limescale in the steam generator. Ultra-fast interim cleaning cleans iCombi Pro in only 12 minutes, all cleaning programs can also run overnight without the need for supervision. The iCareSystem is particularly efficient and environmentally friendly, consuming small quantities of phosphate-free care products, water, and energy. This means that the iCombi Pro is always hygienically clean without manual work and at minimal costs.

### Capacity

- > Twenty (20) Full-size sheet pans or Fourty (40) Steam table pans or Twenty (20) 2/1 GN accessories
- > Mobile oven rack with 2 1/2" inch rack spacing and tandem casters (63 mm)
- > Handle holder for mobile rack
- > Large selection of accessories for various cooking procedures, such as grilling, braising or baking
- > For use with 2/1, 1/1, 2/4 GN accessories

### Combi-steamer mode

- > Steaming 86 °F - 266 °F
- > Convection 86 °F - 572 °F
- > Combination of steam and convection 86 °F - 572 °F



## Unit description and functions

### Intelligent functions

- > Intelligent climate management that measures, adjusts and controls the humidity down to the exact percentage
- > The actual measured humidity in the cooking cabinet can be adjusted and viewed
- > Dynamic air turbulence in the cooking cabinet thanks to three intelligent, reversible, high-performance fan wheels with five fan wheel speeds, intelligently actuated and manually programmable
- > Intelligent cooking path regulation and automatic adjustment of cooking steps in order to achieve the target results, e.g., browning and degree of doneness, safely and efficiently - regardless of product size, load quantity, or who is using the unit
- > Monitoring accurate to the second and calculation of browning on the basis of the Maillard reaction to reproduce ideal cooking results
- > Adjust intelligent cooking methods or switch between iCookingSuite and iProductionManager for maximum flexibility
- > Intelligent cooking step to proof baked goods
- > Individual, intuitive programming of up to 1,200 cooking programs with up to 12 steps using drag-and-drop.
- > Easy transfer of cooking programs to other cooking systems through secure cloud connection with ConnectedCooking or via USB stick
- > iProductionManager, the automated, intelligent planning and controlling tool, organizes multiple cooking processes and mixed loads perfectly. Automatic closing of planning gaps. Automatically optimize schedules and energy consumption in planning and target time preparation to start or end cooking dishes at the same time.
- > Automatically resumes and optimally completes cooking processes following power outages lasting less than 15 minutes
- > Intelligent cleaning system suggests cleaning programs and the required amount of care products based on the degree of soiling within the cooking system
- > Display of the current cleaning and descaling status

### Cooking functions

- > High-performance steam generator for optimal steaming performance even at low temperatures below 212°F
- > Power-steam function: increased steaming power available for Asian applications
- > Integrated, maintenance-free grease separation system without an additional grease filter
- > Cool-down function to quickly cool down the cooking cabinet; additional fast cooling using internal water nozzle
- > Core temperature probe with six measuring points and automatic error correction in the event of incorrect positioning. Optional positioning tool for soft or very small cooking products (accessory)
- > Delta-T cooking for extremely gentle preparation with minimal cooking losses
- > Precise burst-steam injection; water quantities can be set to 4 different levels within a temperature range of 85°F – 500°F for convection or steam-convection combination modes
- > Digital temperature display, can be set to °C or °F, displays target and actual values
- > Cooking cabinet humidity and time displayed digitally; displays target and actual values
- > Time can be set to display in 12- or 24-hour format
- > 24-hour real-time clock with automatic adjustment for daylight savings time when connected to ConnectedCooking
- > Automatic pre-selected starting time with variable date and time
- > Integrated hand shower with automatic retraction and switchable spray/jet function
- > Energy-saving, long-lasting LED lighting in the cooking cabinet, with excellent color fidelity to allow quick determination of cooking progress
- > No-charge 4-hour RATIONAL certified chef assistance program

### Occupational and operating safety

- > Electronic safety temperature limiter for steam generator and convection heating
- > Integrated fan wheel brake
- > Contact temperature of the cooking cabinet door max. 163 °F
- > Use of Active Green cleaning tabs and Care tabs (solid cleaning agent) for ideal occupational safety levels
- > HACCP data storage and output via USB or optional storage and management in the cloud-based networking solution ConnectedCooking
- > Tested according to national and international standards for unsupervised operation
- > Maximum tray height 63 inch when using RATIONAL mobile oven rack with 20 trays, 2 4/8 inch rack spacing (loss of USPHS certification)

### Networking

- > Integrated, IP-protected Ethernet interface for wired connection to the cloud-based ConnectedCooking networking solution
- > Integrated Wi-Fi interface for wireless connection to the cloud-based networking solution ConnectedCooking
- > Integrated USB interface for local data exchange
- > Cloud-based ConnectedCooking solution allows central unit management; recipe, shopping cart and program management; HACCP data management; maintenance management

### Cleaning and care

- > Automatic, water pressure-independent cleaning and maintenance system for cooking cabinet and steam generator
- > Nine cleaning programs for unsupervised cleaning, also overnight, with automatic cleaning and removal of limescale deposits within the steam generator
- > Ultrafast cleaning in only 12 minutes for practically uninterrupted, hygienic production
- > Automatic cleaning routine following power outages, ensuring that cooking cabinet remains free of cleaning agents even after the cleaning process has been canceled
- > Use of phosphate and phosphorus-free Active-Green cleaning agent tabs and Care tabs
- > Triple glass pane cooking cabinet door with rear ventilation, thermally reflecting special coating and swiveling glass panes for easy cleaning
- > Inside and outside material: stainless steel DIN 1.4301 / ASTM 304, seamless hygienic cooking cabinet with rounded corners and optimized air flow
- > Glass and stainless steel surfaces allow easy, safe external cleaning; IPX5-class protection against spraying water in all directions
- > Monitoring option for automatic cleaning using the cloud-based ConnectedCooking networking solution

**Operation**

- > High-resolution 10.1 inch TFT color display and capacitive touchscreen with self-explanatory icons for simple, intuitive operation with gestures like swiping and dragging
- > Acoustic prompts and visual messages when user action is required
- > Central dial with Push function for intuitive selection and confirmation of entries
- > User interface and help function can be set to over 55 languages
- > Basic national cuisine preferences can be selected regardless of language settings. Possible to select additional, local cuisine
- > Specially adapted cooking parameters for international or country-specific dishes can be selected and started regardless of unit language settings
- > Extensive search function including all cooking paths, application examples and settings
- > Context-sensitive support that always shows the current help content for the displayed screen content
- > Start application examples from help file
- > Simple selection of cooking paths using six operating modes and/or five cooking methods
- > Cockpit function to display information about the processes within a cooking path
- > Customization and control of user profiles to prevent operator errors
- > Interactive notifications regarding cooking paths, requested actions, intelligent functions and warnings thanks to Messenger

**Installation, maintenance and environment**

- > Professional installation by RATIONAL-certified technicians recommended
- > Fixed waste water connection conforming to SVGW requirements is permitted
- > Adaptation to the installation site (height above sea level ) through automatic calibration
- > Operation without water softener and without additional manual descaling possible
- > Flush-mounted installation \*
- > Service diagnostic system with automatic service message display, self-test function for active testing of unit functions
- > Remote diagnosis via ConnectedCooking by certified RATIONAL service partners
- > 2-year RATIONAL warranty including parts, labor, and travel and 5-year steam generator warranty\*\*
- > Regular maintenance is recommended. Servicing by RATIONAL service partner according to manufacturer recommendations

\* See the installation or planner manual for details

\*\* Terms and conditions apply, see manufacturer warranty statement at [www.rational-online.com](http://www.rational-online.com)

**Options**

- > MarineLine - marine version
- > SecurityLine – prison / security version
- > MobilityLine – mobile variant
- > HeavyDutyLine – particularly heavy-duty version
- > Integrated fat drain
- > Protection for control panel
- > Safety door lock
- > Lockable control panel

## Technical specifications

### Dimensions and weights

Dimensions (W x H x D)	
Cooking system (body)	42 5/8 x 71 1/8 x 41 3/8 inches
Cooking system (total)	42 3/5 x 73 3/4 x 44 inches
Cooking system with packaging	46 7/8 x 80 3/8 x 48 inches
Maximum working height of top level*	≤ 5 ft. 2 7/8 inches

\* when using a RATIONAL mobile rack, Size 20-full size with 20 levels, level spacing 62 mm

Weights	
Maximum load size per level	66 lb
Maximum total load capacity	396 lb
Weight - electric unit without packaging	740 lb
Weight - electric unit with packaging	842 lb
Weight - gas unit without packaging	835 lb
Weight - gas unit with packaging	936 lb

### Electrical connection conditions

Voltage 3 AC 208 V / 240V	
Connected loads - electric	67.9 kW
Steam power	54 kW
Convection power	66 kW
Breaker	200 A
Connection impedance	0.09 Ω
RCD type	B
Cable diameter	AWG 3/0 194°F
Voltage 3 AC 440 V / 480 V	
Connected loads - electric	67.9 kW
Steam power	54 kW
Convection power	66 kW
Breaker	100 A
Connection impedance	0.09 Ω
RCD type	B
Cable diameter	AWG 2 194°F

Not supplied with cable connection

### Connected loads - gas

Natural gas G20	
Nominal heat load, total	303500 BTU
Nominal heat load, Steam mode	193500 BTU
Nominal heat load, Hot Air mode	303500 BTU
Required connection flow pressure	6.5 – 10 inch w.c.
Liquid gas	
Nominal heat load, total	296500 BTU
Nominal heat load, Steam mode	189000 BTU
Nominal heat load, Hot Air mode	296500 BTU
Required connection flow pressure	10 – 15 inch w.c.

1" NPT with 1" gas shut off

Additional gas types and voltages available on request

### Connected loads - gas

Voltage 2 AC 208 V	
Connected loads - gas	2.2 kW
Breaker	15 A
RCD Type	B

All gas units are supplied with cord.

### Connection conditions water

Water inlet (pressure hose), each	3/4"
Water pressure (flow pressure), each	14.5-87.0 psi
Water drain, each	2" OD
Maximum flow rate per cooking system	3.17 gal/min

### Water quality requirements

Untreated water can be 0 to 24.5 gr/gal (0 to 420ppm) hardness. We do not recommend treated water hardness < 5 gr/gal (86ppm) because the water could be corrosive. Sodium ion exchangers are not recommended; H+ Ion exchange systems are recommended. Water that does not meet the following minimum standards will require the proper conditioning

Contaminant	Water Requirements	If > than recommended
Sand / Particles	< 15 μm	Particle filter
Chlorine (Cl <sub>2</sub> )	< 0.12 gr/gal (0.2 ppm)	Active carbon filter
Chloride (Cl <sup>-</sup> )	< 4.68 gr/gal (80 ppm)	RO

### Connected loads - exhaust air and thermal load

Latent heat load	10331 BTU
Sensible heat emission	13667 BTU
Sound level (electric)	60 dBA
Sound level (gas)	65 dBA

### Connection loads - data

LAN data interface	RJ45
WiFi data interface	IEEE 802.11 a/g/n

### Minimum distances at installation

#### Clearance Requirements

To facilitate servicing, we recommend leaving a 20" (500 mm) gap on the left-hand side of the unit. If there is not 20" (500 mm) left side clearance available, provisions for moving the unit to the left for service access must be made. Such provisions include, but are not limited to, having quick connections (water, gas, etc.) and lengthened electrical connections with flexible cords.

If there are no external heat sources acting on the unit, there should be at least 2" (50 mm) of clearance on either side of the unit. The back of the unit can be mounted flush with the wall.

If a high temperature heat source is on the left side of the unit, clearance of at least 14" (350 mm) must be maintained on the left-hand side. This clearance may be reduced to 2" (50 mm) if a heat shield is used (see accessories).

Recommended clearance from unobstructed rear exhaust pipes and any surface collecting grease or flammable material; 16" (400 mm) gas, 10" (254 mm) electric. It is recommended to have a hood overhang of 6" (150 mm) to 18" (450 mm) at the front of the unit and 6" (150 mm) on the sides if installed at the end of the cooking line. Please refer to the Installation Manual for additional technical data and for instructions on installation and setup.



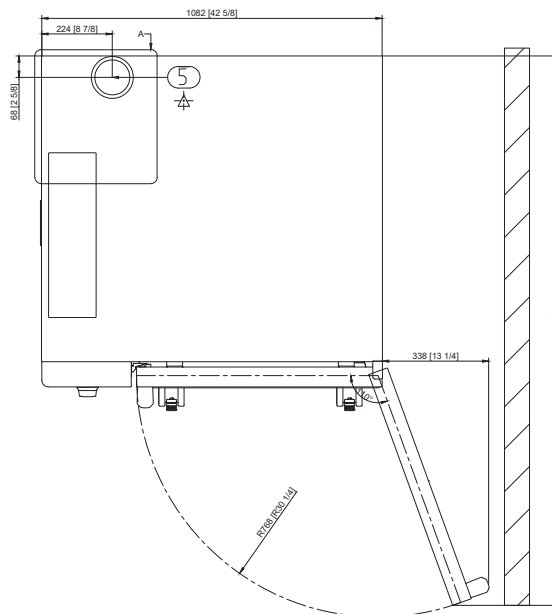
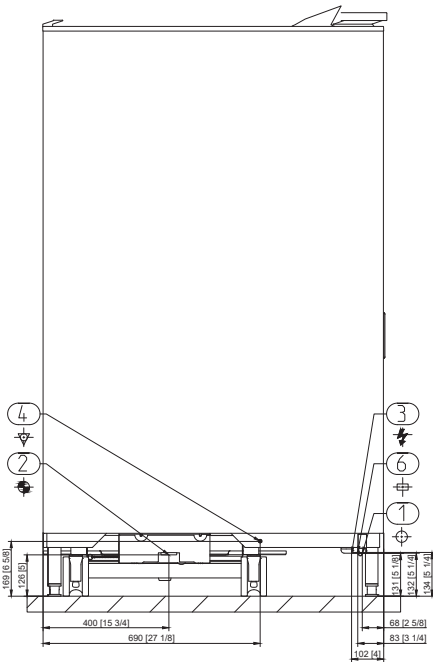
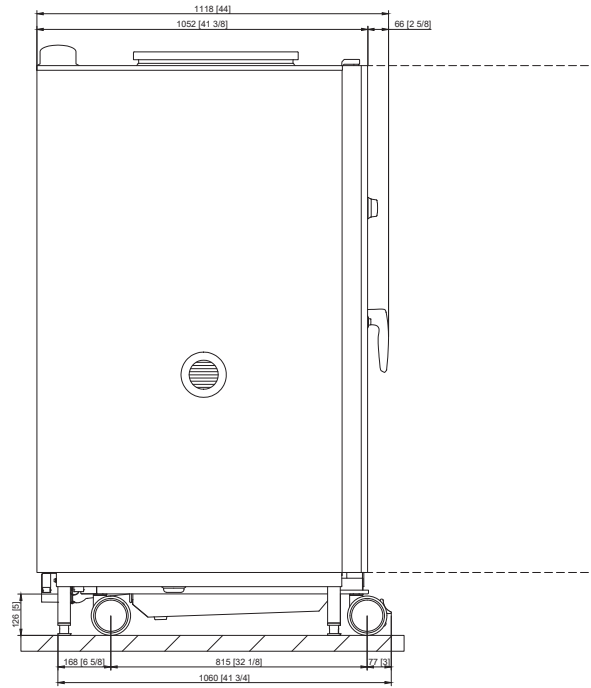
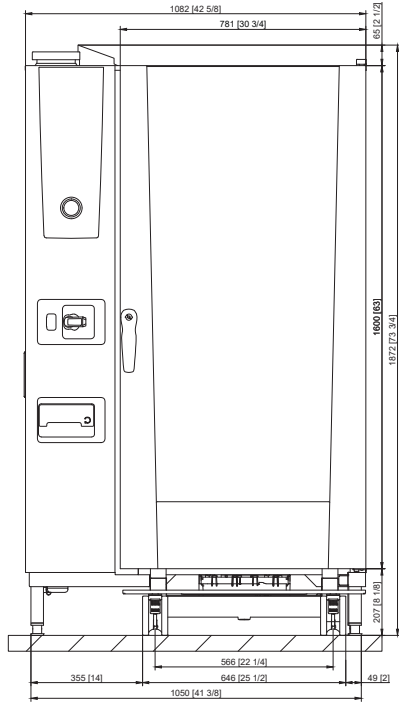
**Terms and conditions of installation**

- > Observe all local and country-specific standards and regulations regarding the installation and operation of industrial cooking appliances. The local standards and regulations for interior ventilation systems must also be taken into account.
- > To use ConnectedCooking, an RJ45 network socket or a WLAN connection option (IEEE 802.11 a/g/n) must be in place on-site. For optimal performance, a data rate of at least 100 MB/s is required.

**Approvals**



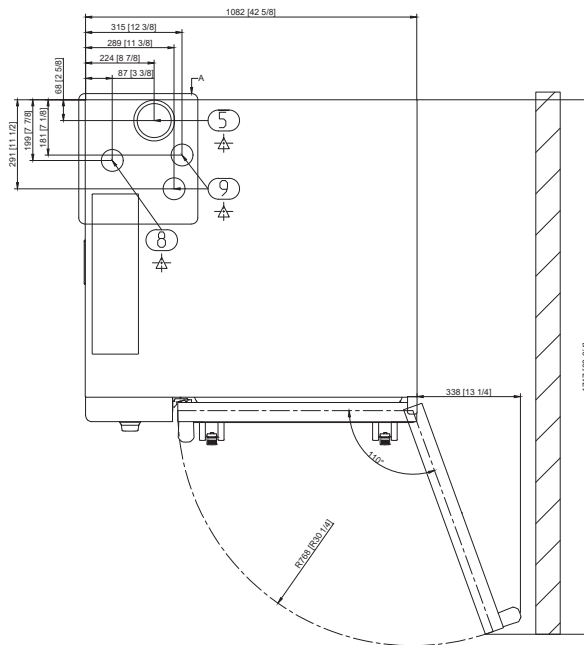
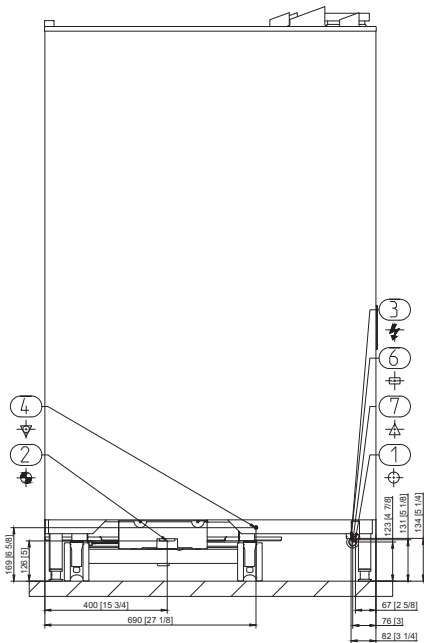
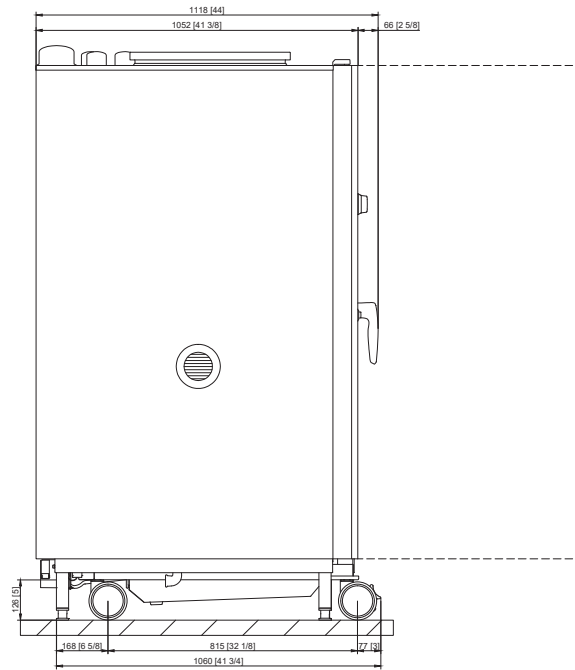
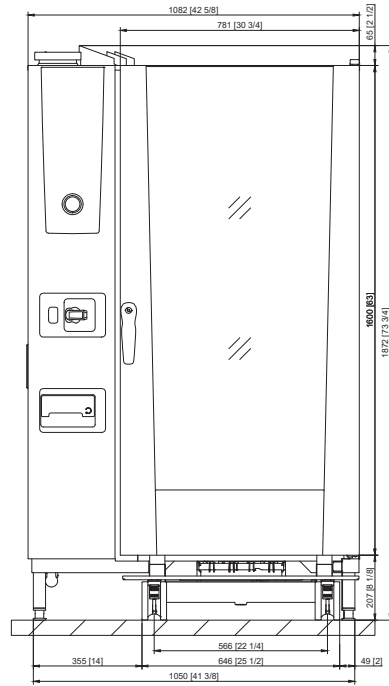
Technical drawing, electrical



1	Water inlet
2	Water drain
3	Electrical connection
4	Equipotential bonding
5	Ventilation pipe
6	Ethernet interface

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Technical drawing, gas



1	Water inlet
2	Water drain
3	Electrical connection
4	Equipotential bonding
5	Ventilation pipe
6	Ethernet interface
7	Gas connection
8	Exhaust pipe gas (steam)
9	Exhaust pipe gas (convection)

## Accessories

> 10 full size stainless steel grids included with delivery of the cooking system

Accessories	Item number
RATIONAL Active Green cleaning agent tabs – guarantee the best cleaning performance	Item no. 56.01.535
RATIONAL Care tabs – effectively prevent limescale deposits	Item no. 56.00.562
Condensation breaker – diverts steam and vapors to an existing exhaust air system Sizes 20-half size and 20-full size	Item no. 60.75.326
RATIONAL USB stick – to securely transfer cooking programs and HACCP data	Item no. 42.00.162
Ramp – evens out inclines (up to 3%) allowing mobile rack to be rolled in smoothly Size 20-full size	Item no. 60.22.380
Full size sheet pan adapter	Item no. Top 60.22.392 Item no. Below 60.22.393
Heat shield – for installing a unit near a heat source, e.g. a grill - Size 20-full size	Item no. 60.75.826
Mobile catering stand - especially for heavy mobile catering usage	Item no. 60.22.496
Mobile oven rack and mobile plate oven rack – for simple loading outside the cooking system	See Cooking Systems and Accessories catalog
RATIONAL Double Water Filter - for Combi Duo 6-full size/6-full size and 6-full size/10-full size or if used for more than 2 units	Item no. 1900.1150US

We offer a wide range of cooking accessories to help you achieve ideal cooking results; for more information, please consult our accessories brochure, ask your dealer, or visit [www.rational-online.com](http://www.rational-online.com)

Planner	RATIONAL USA Inc.
	1701 Golf Road, Suite C-120, Commerce Rolling Meadows, IL 60008 Toll Free: 888-320-7274 Fax: 847-755-9583 Email: <a href="mailto:info@rational-online.com">info@rational-online.com</a> Visit us on the internet: <a href="http://www.rational-online.com">www.rational-online.com</a>



## Submittal Sheet

01/09/2023

### ITEM# 53 - CONVECTION OVEN, GAS (2 EA REQ'D)

Vulcan VC44GD

Convection Oven, gas, double-deck, standard depth, solid state controls, electronic spark igniters, 60 minute timer, (5) nickel plated racks per oven, 8" high legs, stainless steel front, top & sides, stainless steel doors with windows, (2) 50,000 BTU, NSF, CSA Star, CSA Flame, ENERGY STAR®

#### ACCESSORIES

Mfr	Qty	Model	Spec
Vulcan	2		1 year limited parts & labor warranty, standard
Vulcan	2		Natural gas (specify elevation if over 2,000 ft.)
Vulcan	2		(2) 120v/60/1-ph, 15.4 amps total, (2) cords with plugs, standard
Vulcan	2		Gas manifold piping included with stacking kit to provide single point gas connection
Vulcan	2		Simultaneous doors, bottom oven
Vulcan	2		Casters, set of (4) in lieu of standard legs

### ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	120	60	1	Cord & Plug			7.7				
2	120	60	1	Cord & Plug			7.7				

### GAS

	SIZE	MBTU	KW
1	3/4"	100	

### STEAM

	INLET SIZE	RETURN SIZE	LB/HR	PSIG (min)	PSIG (max)
1					

## OVENS

**VULCAN****VC44G SERIES  
DOUBLE DECK GAS CONVECTION OVENS**

**Model VC44GD**  
shown with optional casters

**SPECIFICATIONS**

Double section gas convection oven, Vulcan-Hart Model No. (VC44GD) (VC44GC). Stainless steel front, sides, top and legs. Independently operated stainless steel doors with double pane windows. Non-sag insulation applied to the top, rear, sides, bottom and doors. Porcelain enamel on steel oven interiors measures 29"w x 22 $\frac{1}{8}$ "d x 20"h. Two interior oven lights per section. Five nickel plated oven racks per section measure 28 $\frac{1}{4}$ " x 20 $\frac{1}{2}$ ". Eleven position nickel plated rack guides with positive rack stops. One 50,000 BTU/hr. burner per section. 100,000 total BTU/hr. Electronic spark igniters. Furnished with a two speed  $\frac{1}{2}$  H.P. oven blower-motor per section. Oven cool switch for rapid cool down. 120 volt, 60 Hz, 1 ph power supply required. 6' cord and plug. 7.7 amps total draw per section.

**Exterior Dimensions:**

40 $\frac{1}{4}$ "w x 41 $\frac{1}{8}$ "d (includes motor & door handles) 37 $\frac{3}{4}$ "d (includes motor only) x 70"h on 8" legs.

CSA design certified. NSF listed.

**SPECIFY TYPE OF GAS WHEN ORDERING.**  
**SPECIFY ALTITUDE WHEN ABOVE 2,000 FT.**

- VC44GD** Solid state temperature controls adjust from 150° to 500°F. 60 minute timer with audible alarm.
- VC44GC** Computer controls with digital time and temperature readouts. 99-hour timer with audible alarm. Roast and Hold cycle. One hundred programmable menu selections. Shelf I.D. programming.

Double deck ovens are supplied as separate units with a stacking kit.

**STANDARD FEATURES**

- Stainless steel front, sides, top and legs.
- Independently operated stainless steel doors with double pane windows.
- 50,000 BTU/hr. burner per section, 100,000 BTU/hr. total.
- Electronic spark igniters.
- $\frac{1}{2}$  H.P. two speed oven blower-motor. 120/60/1 with 6' cord and plug. 7.7 amps per section. 15.4 amps total draw.
- Oven cool switch for rapid cool down.
- Porcelain enamel on steel oven interior.
- Five nickel plated oven racks with eleven rack positions per section.
- $\frac{3}{4}$ " rear gas connection with combination gas pressure regulator and safety solenoid system.
- One year limited parts and labor warranty.

**OPTIONS**

- Kosher friendly control package.
- Complete prison package.
  - Security screws only.
- 208V or 240V, 60 Hz, 1 ph, two speed,  $\frac{1}{2}$  H.P. blower motor. 208V, 4.2 amps; 240V, 3.6 amps.
- Casters.
- Simultaneous chain driven doors.
- Control panel mounted on left side of oven.
- Stainless steel rear enclosure.
- Second year extended limited parts and labor warranty.

**ACCESSORIES**

- Extra oven rack(s).
- Rack hanger(s).
- Stainless steel drip pan.
- Flexible gas hose with quick disconnect and restraining device. Consult price book for available sizes.
- Down draft flue diverter for direct vent connection.

**VULCAN**

a division of ITW Food Equipment Group LLC

P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

O V E N S

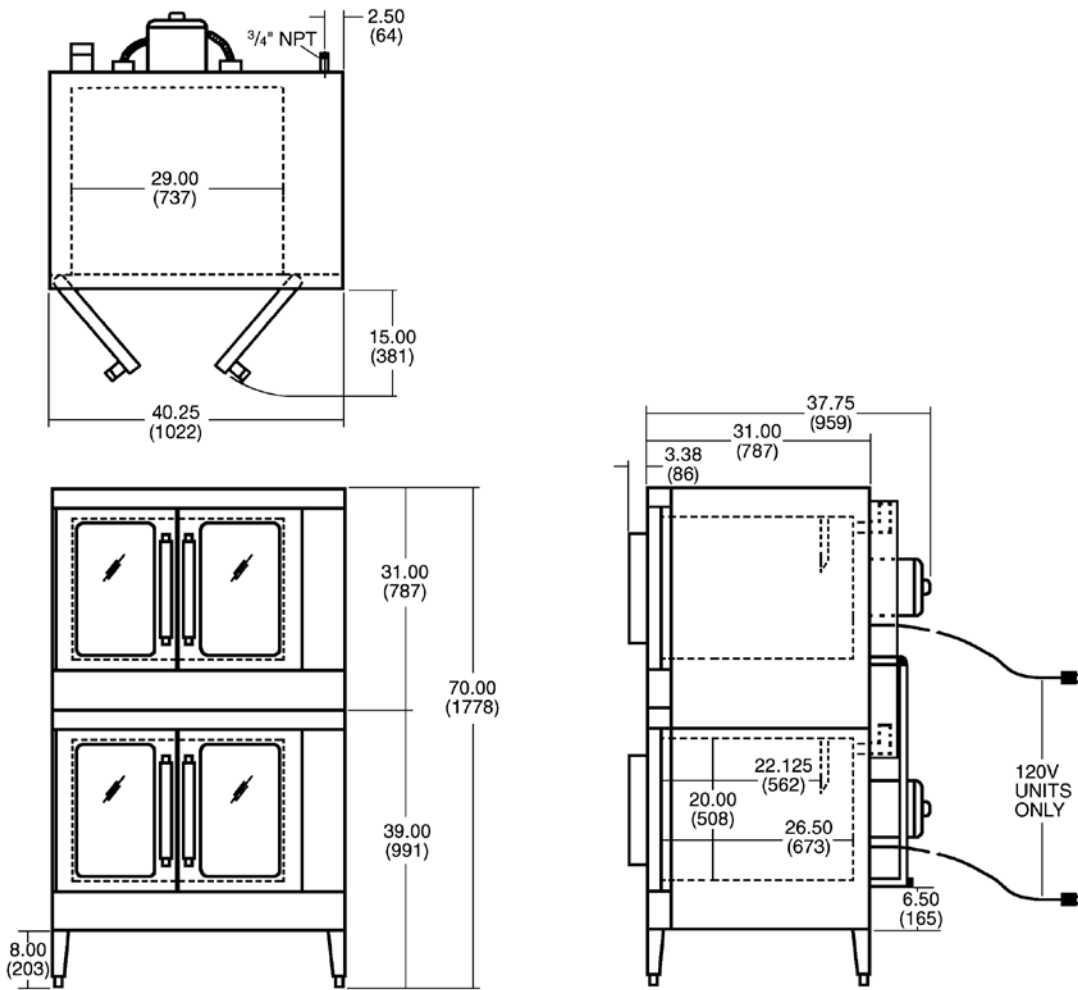


**VC44G SERIES**  
**DOUBLE DECK GAS CONVECTION OVENS**

**INSTALLATION INSTRUCTIONS**

1. A combination gas pressure regulator and safety solenoid system is included in this unit. Natural gas is 5.0" W.C., Propane gas is 10.0" W.C.
2. An adequate ventilation system is required for commercial cooking equipment. Information may be obtained by writing to the National Fire Protection Association, Batterymarch Park, Quincy, MA 02289. When writing, refer to NFPA No. 96.
3. These units are manufactured for installation in accordance with ANSZ223.1 (latest edition), National Fuel Gas Code. Copies may be obtained from American Gas Association Inc., Accredited Standards Committee Z223, 400 N. Capitol St. NW, Washington, DC 20001 or the Secretary Standards Council, NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471.
4. Clearances:
 

Combustible	Non-combustible
Rear	0"
Right Side	2"
Left Side	1"
5. This appliance is manufactured for commercial installation only and is not intended for home use.



MODEL NO.	WIDTH	DEPTH (INCLUDES HANDLES)	HEIGHT	BTU/HR. PER OVEN	TOTAL BTU/HR.	ELECTRICAL	WEIGHT			
							WITH SKIDS & PACKAGING		WITHOUT SKIDS & PACKAGING	
							LBS.	KG	LBS.	KG
VC44G	40 1/4"	41 1/8"	70"	50,000	100,000	120/60/1	928	422	820	372



a division of ITW Food Equipment Group LLC

P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

NOTE: In line with its policy to continually improve its products, Vulcan reserves the right to change materials and specifications without notice.



## Submittal Sheet

01/09/2023

### ITEM# 54 - CONVECTION STEAMER, GAS (1 EA REQ'D)

Cleveland 24CGA10.2

Steamcraft® Gemini™ 10 Convection Steamer, pressureless, gas, 2 compartments with individual generators, (5) 12 x 20 x 2-1/2 pans/compartment capacity, SureCook controls, 60-minute mechanical timer & manual (continuous steaming) bypass switch, left-hand hinged door, controls on right, 1 standard treated & tap water connection, stainless steel construction, 6" adjustable legs with flanged feet, 144,000 BTU total

#### ACCESSORIES

Mfr	Qty	Model	Spec
Cleveland	1		1-year parts & labor warranty, standard
Cleveland	1		5 year pro-rated parts warranty on boilers & steam generators
Cleveland	2		3 year Convection Steamer Door Warranty, standard
Cleveland	1		Performance start-up included at customer request after equipment is installed (Free Water Quality Check included) (contact Cleveland Sales Representative for details)
Cleveland	1		Gas type to be specified
Cleveland	1		(VOS115) 120v/60/1-ph, 2 blowers & controls, 150 watts each (DO NOT connect to GFI outlet)

#### ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	120	60	1				2.0				

#### GAS

	SIZE	MBTU	KW
1	3/4"	144.0	

#### STEAM

	INLET SIZE	RETURN SIZE	LB/HR	PSIG (min)	PSIG (max)
1					

#### WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1				3/8"					
2				3/8"					

#### WASTE

	INDIRECT SIZE	DIRECT SIZE
1	1-1/2"	
2		

#### PLUMBING 1 REMARKS

C1 for Steam Generator, Common Drain for C1 & C2

#### PLUMBING 2 REMARKS

C2 for Condenser





## SteamCraft® Gemini™ 10

TWO COMPARTMENT FLOOR MODEL DESIGN. PRESSURELESS  
CONVECTION STEAMER, TWIN, INDEPENDENT GAS-FIRED GENERATORS

Project \_\_\_\_\_  
Item \_\_\_\_\_  
Quantity \_\_\_\_\_  
FCSI Section 11400 \_\_\_\_\_  
Approved \_\_\_\_\_  
Date \_\_\_\_\_

### Models

- 24-CGA-10.2



### Standard Features

- Cooking Capacity for up to ten 12" x 20" x 2 1/2" deep Cafeteria Pans, five each compartment.
- Totally independent cooking compartments, each has its' own generator, gas valve and water level controls - no shared components
- Exclusive High Efficiency Gas Power Burner (forced air) Generator: Produces more steam for faster cooking while lowering operating costs (72M BTU's per compartment)
- Easy Access Cleaning Port: Each generator has a delimiting port located on the outside, top of the unit
- Generator Steam Standby Mode: Holds generator at a steaming temperature, allows unit to start cooking quickly
- Each compartment has one, 60-Minute Electro-Mechanical Timer with "SureCook" load compensating feature. Manual Bypass Switch for constant steaming.
- Durable 14 Gauge, 304 Stainless Steel construction for cooking cavity and steam generator
- Exclusive Two-Piece Compartment door: Slammable, self-adjusting door provides and airtight seal, reversable door gasket for extended life
- Exclusive Gemini Drain/Power Control System: Simple, reliable 1/2" ball valve style drain automatically turns power ON/OFF
- Exclusive Brass Steam Jets distribute even-high velocity steam throughout cooking compartment for faster cooking times
- Easy, Front -Access Generator Controls comes with a pullout drawer for simple servicing of unit
- 6" Stainless Steel Adjustable Legs with Flanged Feet
- Approvals: CSA (AGA, CSA) and U.L./NSF#4
- Compartment Steam Shut-Off Switch when compartment door is opened

### Short Form Specifications

Shall be Two Compartments, Cleveland Convection Steamer series SteamCraft® Gemini™ 10, Model 24-CGA-10.2, Twin Gas Atmospheric Steam Generator, 72M BTU's input per compartment. Independent steam generator, gas valve and water level control system. Automatic Generator Blowdown. Steam Generator with Automatic Water Fill on start up. Exclusive remote probe-type water level controls. Exclusive Brass "Steam Jet" distribution system. Two-piece free-floating compartment door. Type 430 Stainless Steel exterior and cooking compartments. Pullout service drawer for controls and Gemini Drain/Power Control System. Exclusive Cold Water Condenser design. Choice of Compartment Controls. Manual By Pass for continuous steaming.

### Options & Accessories

- Electronic Timer with Compensating Feature (ETC)
- Propane Gas (PG)
- Dissolve® Descale Solution, 6 one gallon container w/ quart markings (106174)
- Water Filters
- Hinged Right Door, controls on right

SteamCraft® Generator Style High Speed Convection Steamers

KE004046-23

760 Beta Drive, Unit D  
Mayfield Village, Ohio 44143

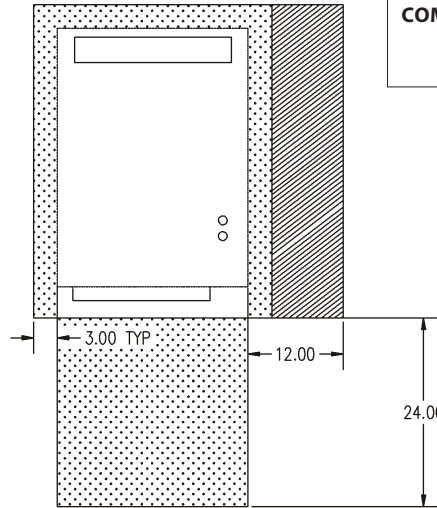
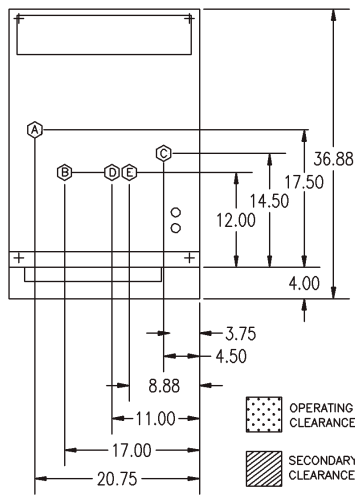
Tel 1.216.481.4900  
Fax 1.216.481.3782  
Email [steam@clevelandrange.com](mailto:steam@clevelandrange.com)

[www.clevelandrange.com](http://www.clevelandrange.com)  
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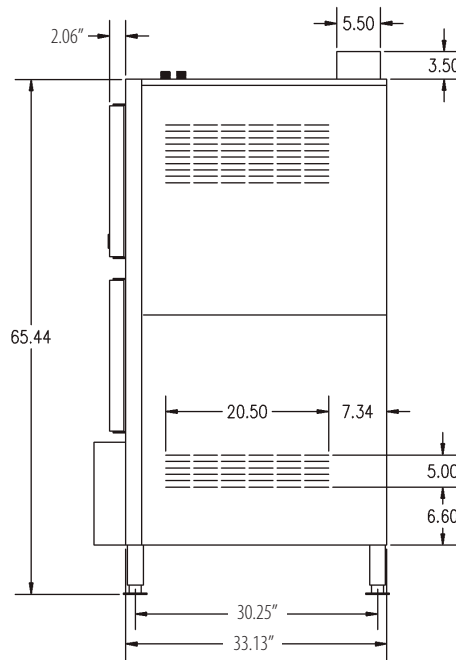
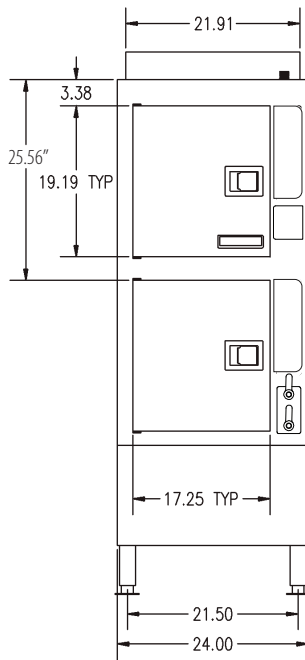




SteamCraft® Generator Style High Speed Convection Steamers



**COMPARTMENT HAS CAPACITY FOR:**  
 • Five, 12" x 20" x 2 1/2" deep Cafeteria Pans



WATER QUALITY REQUIREMENTS (Boilers, Generators)	
TTDS:	50-250 ppm
Hardness:	50 - 200 mg (3 - 12 gpg)
pH value:	7.0 - 8.5
CL (Chloride):	max 50 ppm
Cl2 (free chlorine):	max 0.1 ppm
SiO2 (silica):	max 13 ppm
NH2Cl: (mono-chloramine)	max 0.1 ppm
Total Alkalinity:	50 - 100 ppm

A GAS			B ELECTRIC	CD COLD WATER	CLEARANCE	D DRAINAGE
1 1/4" IPS line size, 3/8" connection			120V-1Phase, 60 Hz. 2 Blowers & Controls 150 watts each  ** Do not connect to GFI outlet. See note below.	35 psi minimum 60 psi maximum  1/2" IPS-M NPT for Generator  1/2" IPS-M NPT for Condenser	Right - 3", Left - 3", Rear - 3"  (12" on control side if adjoining wall or equipment is over 30" high for service access)  <b>Contact factory for variances to clearances.</b>	1/2" IPS-M  Do not connect other units to this drain Drain must not be located beneath the steamer itself Preferred floor drain location should be a minimum distance (from the unit) of at least 12" from the left side, 12" from the right side, 6" from the front and 6" from the rear. Do not use PVC pipe
NATURAL	PROPANE	BTU				
Piping 3/8" N.P.T.	Piping 3/8" N.P.T.	72,000 each				
Supply pressure 4.50" W.C. Min. 14.00" W.C. Max.	Supply pressure 11.00" W.C. Min. 14.00" W.C. Max.	Generator, 144,000 total				
Manufacturer must be notified if unit will be used above 2,000 feet						

**NOTES:**  
 \*\*DO NOT CONNECT TO GFI OUTLET. CLEVELAND RANGE RECOMENDS GAS FIRED 120 VOLT STEAMERS BE HARD WIRED DIRECTLY TO ELECTRICAL SYSTEM.  
 Cleveland Range reserves right of design improvement or modification, as warranted.  
 Many regional, state and local codes exist and it is the responsibility of the owner and installer to comply with the codes.  
 Cleveland Range equipment is built to comply with applicable standards for manufacturers. Included among those approval agencies are U.L./NSF#4 and CSA (AGA, CGA).

(NOT TO SCALE)

760 Beta Drive, Unit D  
 Mayfield Village, Ohio 44143

Tel 1.216.481.4900  
 Fax 1.216.481.3782  
 Email steam@clevelandrange.com

www.clevelandrange.com  
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 06 / 2021





**Submittal Sheet**

01/09/2023

**ITEM# 55 - HD RANGE, 36", 6 OPEN BURNERS (1 EA REQ'D)**

Vulcan V6B36S

V Series Heavy Duty Range, gas, 36", (6) 35,000 BTU open burners, cast iron grates, standard oven, stainless steel front, front top ledge, sides, base, burner box & stub back, 6" adjustable legs, 260,000 BTU, CSA, NSF

**ACCESSORIES**

Mfr	Qty	Model	Spec
Vulcan	1		1 year limited parts & labor warranty, standard
Vulcan	1		Natural gas (specify elevation if over 2,000 ft.)
Vulcan	1		NOTE: A regulator must be used on this equipment
Vulcan	1		1-1/4" rear gas connection, standard
Vulcan	1		Rear gas connection: cap & cover, both ends

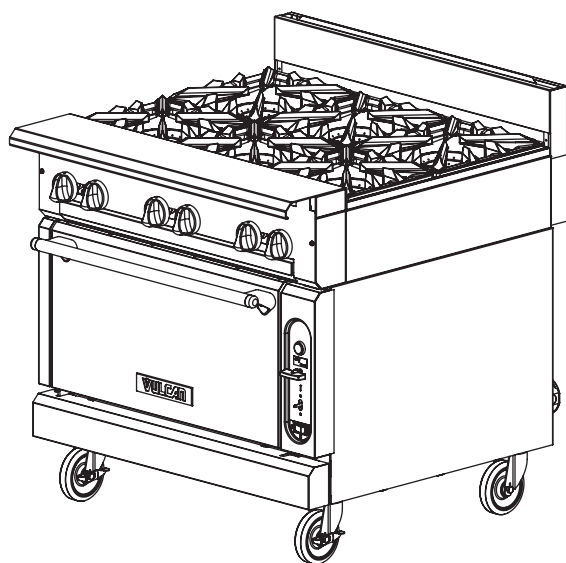
**GAS**

	SIZE	MBTU	KW
1		260.0	
2	1-1/4"		

**STEAM**

	INLET SIZE	RETURN SIZE	LB/HR	PSIG (min)	PSIG (max)
1					
2					

## HEAVY DUTY COOKING

**VULCAN****HEAVY DUTY GAS RANGE  
6-BURNER / 36" WIDE GAS RANGE****Model V6B36C**

shown on a convection oven base

**SPECIFICATIONS**

36" wide heavy duty gas range, Vulcan Model No. V6B36 (modular) and V6B36B (cabinet base) or V6B36S (standard oven base) and V6B36C (convection oven base). Modular construction for ease of installation. Stainless steel front, plate ledge, front top ledge with pull-out condiment rails, sides, base, stub back, and 6" adjustable legs on all "B", "S", & "C" models. Stainless steel extra deep crumb tray. Six 35,000 BTU/hr. cast burners with lift-off burner heads. Individual pilots and controls for each burner. Heavy duty cast burner grates, easy lift-off 11" x 12" in front, 14" x 12" in rear. Grates are separate from aeration bowl for ease of cleaning. **Standard Oven:** 50,000 BTU/hr. with porcelain oven bottom, sides and indoor panel. **Convection Oven:** 32,000 BTU/hr. with porcelain oven bottom, sides and interior door panel (115v-1 phase blower motor, 4 amps, 6' cord and plug). Oven measures 27"w x 27"d x 13"h. Standard oven thermostat adjusts from 150° – 550°F. Convection oven adjusts from 175° – 550°F and the optional finishing oven for standard ovens adjusts from 300° – 650°F. Standard oven supplied with one rack, convection oven with two racks. Both ovens allow for three rack positions. Oven door is heavy duty with counter weight door hinges. 1¼" diameter front gas manifold and 1¼" rear gas connection, capped. Total input 260,000 BTU/hr.

**Exterior Dimensions:**

36¾"d x 36"w x 36"h on 6" adjustable legs

- V6B36** 6-Burners / Modular
- V6B36B** 6-Burners / Cabinet Base
- V6B36S** 6-Burners / Standard Oven
- V6B36C** 6-Burners / Convection Oven

**STANDARD FEATURES**

- Stainless steel front, front top ledge, burner box, sides, base, and stub back
- 1¼" diameter front gas manifold with 1¼" rear gas connection (capped)
- 35,000 BTU/hr. open top burners with lift off heads
- 50,000 BTU/hr. standard oven burner
- 32,000 BTU/hr. convection oven burner
- Porcelain oven cavity
- Individual pilots and controls for each burner
- Heavy-duty cast grates
- 4" stainless steel stub riser
- 6" adjustable stainless steel legs for "S", "C", and "B" models (no legs for modular model)
- Stainless steel cabinet base door
- Universal rack guides, one removable shelf (cabinet base)
- One year limited parts and labor warranty

**OPTIONAL FEATURES (Factory Installed)**

- Cap and cover front manifold
- Stainless steel oven cavity
- 650°F oven thermostat and steel hearth ("S" models)
- Fan cooling package ("C" models)
- 4" adjustable flanged feet for modular models
- Less legs for dolly mounting for "S", "C", and "B" models
- 3" high toe base for curb mounting
- Common condiment type, telescoping plate rails

**ACCESSORIES (Packaged & Sold Separately)**

- 1", or 1 ¼" gas pressure regulator (specify gas type – pack loose)
- Set of 4 casters, 6" high (two locking)
- 6" adjustable flanged feet for "S", "C", and "B" models
- Extra removable shelves for use with Universal rack guides (for cabinet base)
- "S" Grates
- Banking strip
- Common condiment type, telescoping plate rails (starting at 24" length)
- 10", 22", or 34" high back risers (no shelf)
- 22" single deck solid or flo-thru high shelf risers
- 34" double deck solid or flo-thru high shelf risers
- Dolly frames
- Flexible gas hose – quick disconnect & restraining device

**VULCAN**

a division of ITW Food Equipment Group LLC

P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote &amp; Order Fax: 1-800-444-0602

HEAVY DUTY COOKING



HEAVY DUTY GAS RANGE  
6-BURNER / 36" WIDE GAS RANGE

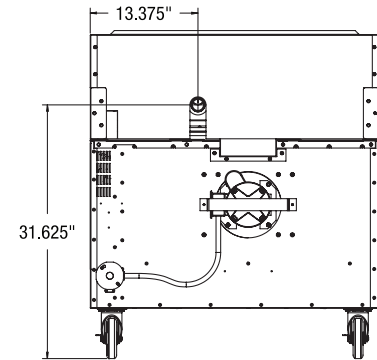
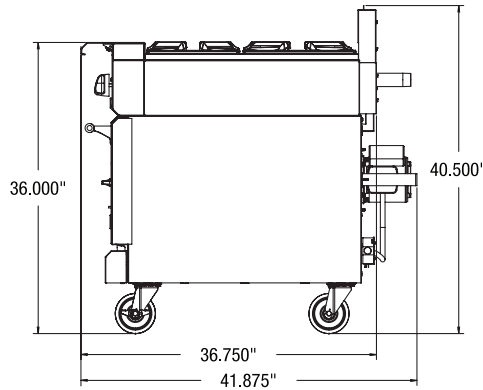
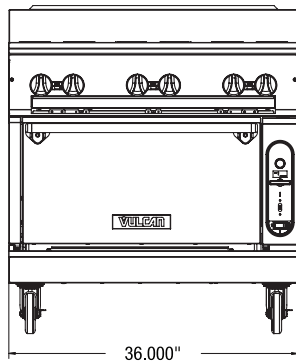
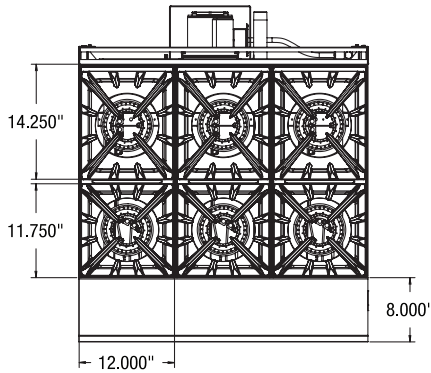
INSTALLATION INSTRUCTIONS

1. A properly sized gas pressure regulator suitable for battery or single unit application must be furnished and installed. Natural gas 6.0" W.C., propane gas 10.0" W.C.
2. An adequate ventilation system is required for commercial cooking equipment. Information may be obtained by writing to the National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269, www.NFPA.org. When writing, refer to NFPA No. 96.
3. These units are manufactured for installation in accordance with ANSZ223.1A (latest edition), National Fuel Gas Code. Copies may be obtained from The American Gas Association, 400 N Capitol St. NW, Washington, DC 20001, www.AGA.org.
4. **Clearances**  

	Rear	Sides
Combustible	10"	10"
Non-combustible	0"	0"
5. For proper combustion, install equipment on adjustable legs or casters. On curb or platform, allow 3½" front overhang. Toe base with leveling bolts are required for curb installation. Specify when ordering.
6. Cannot be battered with GH series equipment.
7. This appliance is manufactured for commercial installation only and is not intended for home use.

**NOTE:** In line with its policy to continually improve its product, Vulcan reserves the right to change materials and specifications without notice.

**Specify type of gas when ordering.  
Specify altitude when above 2,000 feet.**



TOP CONFIGURATION	MODEL NUMBER	DESCRIPTION	TOTAL INPUT BTU / HR	SHIPPING WEIGHT LBS / KG
	V6B36	6-Burners / Modular	210,000	400 / 180
	V6B36B	6-Burners / Cabinet Base	210,000	435 / 196
	V6B36S	6-Burners / Standard Oven Base	260,000	690 / 311
	V6B36C	6-Burners / Convection Oven Base	242,000	730 / 329

This appliance is manufactured for commercial use only and is not intended for home use.



a division of ITW Food Equipment Group LLC

P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

**NOTE:** In line with its policy to continually improve its products, Vulcan reserves the right to change materials and specifications without notice.



## Submittal Sheet

01/09/2023

### ITEM# 56 - CONVECTION OVEN, GAS (1 EA REQ'D)

Vulcan VC44GD

Convection Oven, gas, double-deck, standard depth, solid state controls, electronic spark igniters, 60 minute timer, (5) nickel plated racks per oven, 8" high legs, stainless steel front, top & sides, stainless steel doors with windows, (2) 50,000 BTU, NSF, CSA Star, CSA Flame, ENERGY STAR®

The spec sheet for this item can be viewed on item 53)

#### ACCESSORIES

Mfr	Qty	Model	Spec
Vulcan	1		1 year limited parts & labor warranty, standard
Vulcan	1		Gas type to be specified
Vulcan	1		(2) 120v/60/1-ph, 15.4 amps total, (2) cords with plugs, standard
Vulcan	1		Gas manifold piping included with stacking kit to provide single point gas connection
Vulcan	2		Simultaneous doors, both ovens
Vulcan	1		Casters, set of (4) in lieu of standard legs

#### ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	120	60	1	Cord & Plug			7.7				
2	120	60	1	Cord & Plug			7.7				

#### GAS

	SIZE	MBTU	KW
1	3/4"	100	

#### STEAM

	INLET SIZE	RETURN SIZE	LB/HR	PSIG (min)	PSIG (max)
1					



## Submittal Sheet

01/09/2023

### ITEM# 57 - KETTLE, GAS, TILTING (1 EA REQ'D)

Groen DH-40A

Tilting Kettle, gas, 40-gallon capacity, crank tilt, 2/3 jacket, IPX6 water rated electronic Advanced controls with digital display, 1 minute to 10 hour timer, low (2) and high (7) preset intensities with manual capability, 316 stainless steel liner, floor mounted control console supports, stainless steel construction, bullet feet, electronic ignition, 50 PSI, 0 - 2000' elevation, 100,000 BTU, cCSAus, NSF, Made in USA

#### ACCESSORIES

Mfr	Qty	Model	Spec
Groen	1		(1) year parts & labor, (10) year hemisphere warranty, standard
Groen	1		Gas type to be specified
Groen	1	ELEVO-2000	For elevation between 0 and 2000 (When order is placed, all equipment with elevation specified will be assigned a different Part# by the factory)
Groen	1		115v/60/1-ph, 5.0 amps, std.

#### ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	115	60	1				5.0				

#### GAS

	SIZE	MBTU	KW
1	1/2"	100.0	

#### STEAM

	INLET SIZE	RETURN SIZE	LB/HR	PSIG (min)	PSIG (max)
1					





# TILTING FLOOR KETTLE

## GAS MODELS DH-20/40/60C/A/C2T

Kettle shall be a Groen Model DH (specify gallon capacity and Classic (C), Advanced (A) or Cook2Temp™ (C2T™) controls) stainless steel floor model manual tilting steam jacketed unit, operating with a self-contained gas heated steam source contained within the unit. CookTemp models also come with a probe.

### AVAILABLE MODELS:

#### CLASSIC CONTROLS:

DH-20C (20 GALLON)  
DH-40C (40 GALLON)  
DH-60C (60 GALLON)

#### ADVANCED CONTROLS:

DH-20A (20 GALLON)  
DH-40A (40 GALLON)  
DH-60A (60 GALLON)

#### COOK2TEMP CONTROLS:

DH-20C2T (20 GALLON)  
DH-40C2T (40 GALLON)  
DH-60C2T (60 GALLON)

**CONSTRUCTION:** Kettle interior shall be of type 316 stainless steel, solid one-piece welded construction. The console and all exposed surfaces shall be stainless steel. All controls shall be mounted in a water resistant IPX6-rated enclosure right of the kettle body. The kettle body shall be mounted in a heavy-duty stainless steel combination kettle support tilt trunnion, supported by the stainless steel enclosed base. The base shall have stainless steel tubular legs with height adjustable bullet feet. The trunnion support base shall contain a smooth operating, self locking manual crank tilt mechanism, accessible for installation or maintenance. Kettle body shall have a heavy reinforced bar rim with a welded in butterfly shaped pouring lip for maximum sanitation and durability. Faucet mounting bracket is standard.

**FINISH:** Kettle interior shall be polished to a 180 emery grit finish. Exterior of kettle shall be finished to a bright high buff finish, ensuring maximum ease in cleaning and maintaining brilliant appearance.

### ASME CODE, CSA DESIGN CERTIFIED:

Unit shall be ASME shop inspected, stamped and registered with the National Board for operation up to a maximum working pressure of 50 PSI. Unit shall be design certified by CSA International. (Natural and Propane only.)

**SANITATION:** Unit shall be designed and constructed to meet NSF and known health department and sanitation codes and be NSF listed.

**DRAWOFF:** A 2" tangent drawoff is optional. If drawoff is specified, outlet shall be equipped with removable 1/4" perforated stainless steel strainer.

### SELF-CONTAINED STEAM SOURCE:

Kettle shall have a gas-heated (natural, butane, propane) self-contained steam system to provide kettle temperatures of 150 to approximately 295°F. Unit shall be factory charged with chemically-pure water and rust inhibitors to ensure long life and minimum maintenance.

**CONTROLS:** Controls to be located in right-side water resistant (IPX6-rated) trunnion enclosure:

**Classic -C Models** include: Power ON-OFF switch with indicator light, temperature control knob with 1 to 10 increments, HEAT(ing) indicator light and LOW WATER warning light; **Advanced -A Models** include: Same control features as Classic models with the addition of temperature and time set knob, LED display of set heat level or cook time, buttons for reset of Low Temp and High Temp presets, MANUAL mode button for knob-setting of heat level, TIMER-set button with indicator light; **Cook2Temp -C2T Models** include: Same control features as Classic and Advanced models with the addition of Auto C2T and Manual C2T buttons with core probe connection port, MANUAL mode button for knob-setting of heat level for manual cooking and manual C2T cooking.

**SAFETY SYSTEMS:** Safety systems to include kettle-mounted: pressure-vacuum gauge, pressure relief valve, pressure limit control, water sight glass; plus low-water cutoff, gas regulator valve and kettle tilt automatic gas shutoff.

**PERFORMANCE FEATURES:** Patented fin tube burner assembly delivers 62-65% efficient combustion, depending on size. 20 Gallon Model has 72,000 BTU/HR firing rate with 44,140 BTU/HR into the product; 40 Gallon Model has 100,000 BTU/HR firing rate with 65,000 BTU/HR into the product, and 60 Gallon Model has 150,000 BTU/HR firing rate with 93,000 BTU/HR into the product. Electronic ignition to standing pilot is standard.

**INSTALLATION:** Specify natural, propane, butane, or specific propane/butane mixture. Unit requires 1/2" IPS gas line connection and 115 volt electrical connection. No remote steam source required.

**ORIGIN OF MANUFACTURE:** Designed and manufactured in the United States.



PROJECT NAME:	
LOCATION:	
ITEM NO:	
QTY:	
MODEL NO:	
AIA NO:	
SIS NO:	
CSI SECTION:	



DH-20C Model shown

### OPTIONS/ACCESSORIES:

2" tangent draw-off valve with  
1/4" perforated disk strainer  
1/8" perforated disk strainer  
1/4" perforated disk strainer  
Solid disk strainer  
Basket inserts (TRI-BC)  
Lift-off cover (No. 31)  
Hinged cover kit (No. 51)  
Pan carrier (40 and 60-gallon)  
Kettle brush kit  
Single or double pantry faucets  
Lip strainer  
Contour measuring strip  
Gallon etch marks  
Replacement core probe  
(on C2T models only)

### FLOOR KETTLE

175745 RevE

Revised 04/19





P/N 175854 REV B

TABLE OF DIMENSIONS					
CAPACITY (GALLONS/LITRES)					
20 GAL/76 LITRES		40 GAL/152 LITRES		60 GAL/228 LITRES	
INCHES		MM		INCHES	
A	19 7/8	505	25 3/4	654	30
B	35	889	47	1194	47
C	25 3/4	654	29 1/2	749	30 7/8
D	31	787	26 1/2	673	35 1/2
E	32 3/4	832	34 5/8	879	42 7/8
F	18	457	18 1/4	463	19
G	39 3/8	1000	43 1/8	1095	46 1/4
H	15 5/8	397	13 3/4	349	12 3/8
J	27	686	29 1/4	743	35
K	30 1/4	768	31	787	31 3/4
L	51	1295	60 1/2	1537	61 1/2
M	37 1/4	946	36 1/8	918	43 1/8
N	2	51	5 7/16	138	7 1/2
P					191

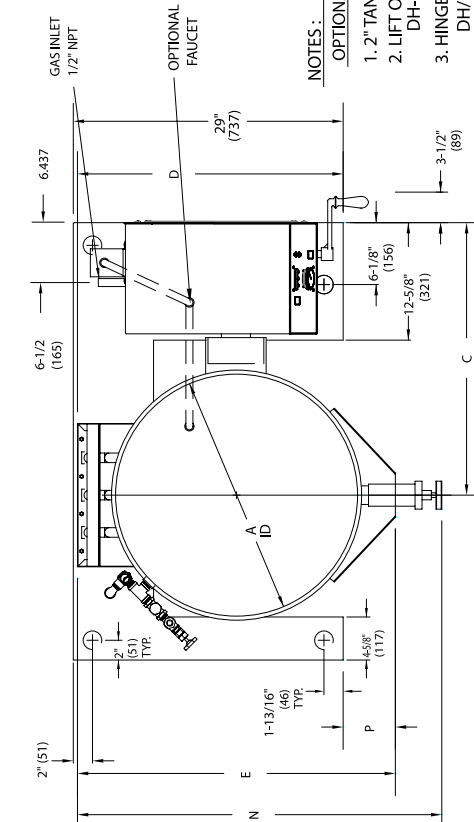
FIRING RATE (BTU/HR) FOR BOTH NATURAL AND LP	
DH/20	72,000
DH/1-40	100,000
DH/60	150,000

OPERATING GAS PRESSURE	
NATURAL	3.5 W.C.
PROPANE	10.0 W.C.

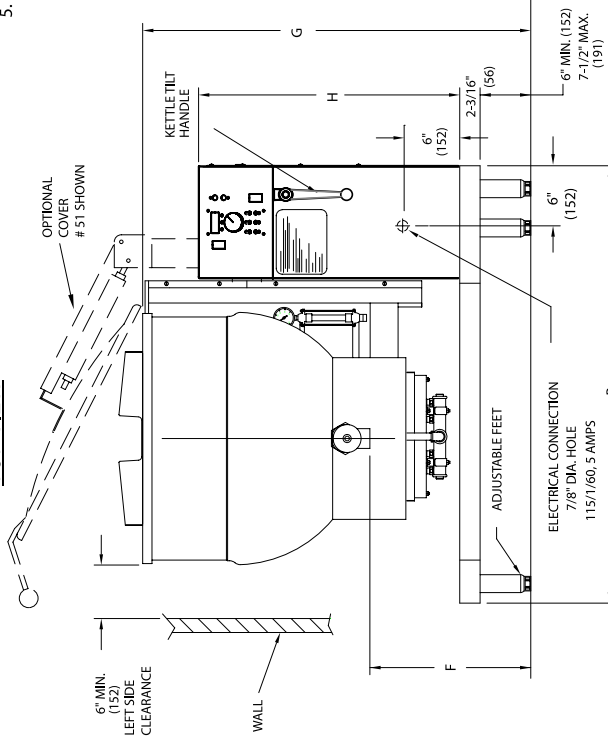
**NOTES:**

- OPTIONAL EXTRA COST FEATURES:
- 1. 2" TANGENT SANITARY DRAW-OFF
- 2. LIFT OFF COVER MODEL # 31 FOR DH-20 & DH/1-40 KETTLES.
- 3. HINGED COVER MODEL # 51 FOR DH/1-40 & DH-60 KETTLES.
- 4. FAUCET WITH SWING SPOUT
- 5. DIMENSIONS IN BRACKETS ( ) ARE MM

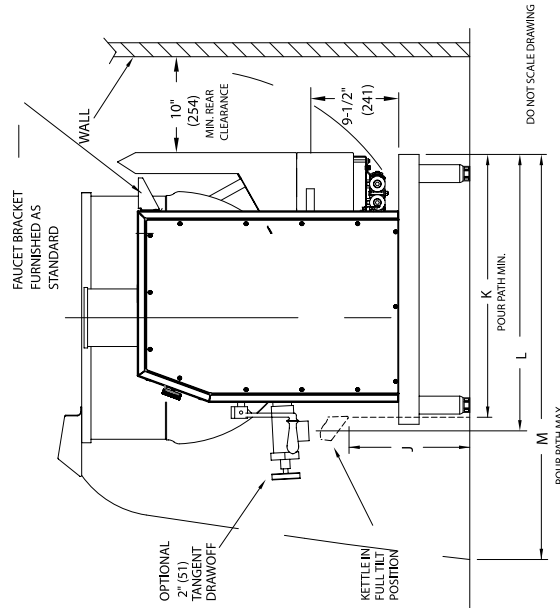
INCOMING GAS PRESSURE TABLE		
TYPE OF GAS	MIN. SUPPLY GAS PRESSURE	MAX. SUPPLY GAS PRESSURE
NATURAL	4.5 W.C.	14.0 W.C.
PROPANE	11.0 W.C.	14 W.C.



**TOP VIEW**



**FRONT VIEW**



**RIGHT SIDE VIEW**



CLASSIC CONTROL



ADVANCED CONTROL



COOK2TEMP CONTROL



## Submittal Sheet

01/09/2023

### ITEM# 58 - TILTING SKILLET BRAISING PAN, GAS (1 EA REQ'D)

Groen BPM-40GA

Braising Pan, gas, 40-gallon capacity, 10" deep pan, 38" pan height, IPX6 water rated electronic Advanced controls with digital display, 1 minute to 10 hour timer, 175° - 400°F preset temperatures along with manual setting capability, manual tilt, standard etch marks, faucet bracket, round tubular open leg base, stainless steel construction, bullet feet, electric spark ignition, 144,000 BTU/hr, cCSAus, NSF, IPX6, Made in USA

#### ACCESSORIES

Mfr	Qty	Model	Spec
Groen	1		(1) year parts & labor, (10) year pan warranty, standard
Groen	1		115v/60/1-ph, 5.0 amps, standard
Groen	1		Gas type to be specified
Groen	1	ELEVO-2000	For elevation between 0 and 2000 (When order is placed, all equipment with elevation specified will be assigned a different Part# by the factory)

#### ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	115	60	1				5				

#### GAS

	SIZE	MBTU	KW
1	1/2"	144.0	

#### STEAM

	INLET SIZE	RETURN SIZE	LB/HR	PSIG (min)	PSIG (max)
1					



# TILTING BRAISING PAN

## GAS MODELS BPM-30/40GC/GA/GC2T

Braising pan shall be a Groen gas heated manual tilting BPM Series (specify 30 or 40 gallon, Classic (C), Advanced (A) or Cook2Temp™ (C2T™) controls) model with 10" deep pan body with 3" radius corners, 5/8" thick stainless steel clad cooking surface mounted on open leg stand with height-adjustable bullet feet. CookTemp models also come with a probe.

### AVAILABLE MODELS:

#### CLASSIC CONTROLS:

BPM-30GC (30 GALLON)  
BPM-40GC (40 GALLON)

#### ADVANCED CONTROLS:

BPM-30GA (30 GALLON)  
BPM-40GA (40 GALLON)

#### COOK2TEMP CONTROLS:

BPM-30GC2T (30 GALLON)  
BPM-40GC2T (40 GALLON)

**CONSTRUCTION:** The pan body shall be of type 304 stainless steel, solid one-piece welded heavy-duty construction, with 10" pan depth. All exposed surfaces shall be stainless steel. The cooking surface is a heavy 5/8" thick stainless steel clad plate with specially designed welded heat transfer fins, heated by the gas burner/combustion chamber. This combination delivers more uniform heat transfer over the entire cooking surface. The heavy plate prevents warping or distortion. Controls and tilt mechanism are mounted in a stainless steel water resistant IPX6 rated housing at the right side of the pan body. Braising pan shall come standard with a mounting bracket for either right-side, left-side or right-rear faucet mounting. Graduated fill-level marks in both gallons and liters are standard.

**FINISH:** Interior of braising pan shall be polished to a 100 emery grit finish on C/A models, 180 emery grit on C2T models. Exterior of braising pan shall have a #3 finish, ensuring maximum ease in cleaning and maintaining appearance.

**CSA DESIGN CERTIFICATION:** Braising pan shall be design-certified by CSA International (formerly AGA) for use with Natural Gas or LP Gas.

**SANITATION & NSF LISTING:** Braising pan shall be designed and constructed to be NSF listed, meeting all known health department and sanitation codes. True open leg tubular design and 3" radius pan interior make cleaning easier.

**MANUAL TILT:** The braising pan shall have a smooth-action, quick-tilting body with manual crank and worm-and-gear tilt mechanism, which provides precise control during pouring. Pan body shall tilt to vertical in 24 turns and past vertical to assist in cleaning.

**CONTROLS:** All controls to be located in a right-front mounted water resistant (IPX6 rated) enclosure:

**Classic -C Models** include: Power ON-OFF switch with indicator light, temperature control knob with 175 to 400°F (79 to 204°C) range increments and HEAT(ing) indicator light;

**Advanced -A Models** include: Same control features as Classic models with the addition of temperature and time set knob (175 to 400°F/79 to 204°C range), LED display of set temperature or cook time, buttons for reset of Low Temp and High Temp presets, MANUAL mode button for knob-setting of pan temperature, and TIMER-set button with indicator light;

**Cook2Temp -C2T Models** include: Same control features as Classic and Advanced models with the addition of Auto C2T and Manual C2T buttons with core probe connection port, MANUAL mode button for knob-setting of pan temperature for manual cooking and manual C2T cooking.

**PERFORMANCE FEATURES:** Braising pan shall be equipped with controls that allow operation at 7 degree angle to facilitate griddling. Braising pan shall be thermostatically-controlled for automatic shut-off when desired temperature is reached and automatic power ON when temperature falls below desired setting. BPM-30GC and 30GA Models have a firing rate of 104,000 BTU/hr. BPM-40GC and -40GA Models have a firing rate of 144,000 BTU/hr. Electronic intermittent pilot ignition system is standard. Braising pans have high limit thermostat as a safety feature.

**INSTALLATION:** Unit requires 1/2" NPT gas connection. Requires 115 Volt, single-phase, 60 HZ, 5 AMP electric supply.

**ORIGIN OF MANUFACTURE:** Designed and manufactured in the United States.



PROJECT NAME:	
LOCATION:	
ITEM NO:	
QTY:	
MODEL NO:	
AIA NO:	
SIS NO:	
CSI SECTION:	



*BPM-30GA Model shown*

### OPTIONS/ACCESSORIES:

- Single pantry water fill faucet
- Double pantry water fill faucet
- Single or double pantry faucet with spray hose assembly (48" or 60")
- Steamer pan carrier
- 2" tangent drawoff valve (option: must be ordered with unit)
- Strainer for tangent draw-off valve
- Gas quick disconnect
- Caster kit w/restraint cable
- Flanged feet
- Pouring lip strainer
- Steamer pan inserts
- Replacement core probe (on C2T models only)

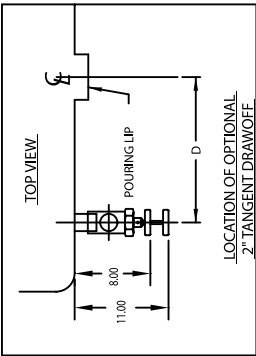


BPM-30/40GC/GA/GC2T



P/N 146195 REV G

TABLE OF DIMENSIONS		
MODEL	BPM-30G	BPM-40G
DIMS.	INCH	MM
A	26.25	667
B	32.00	813
C	38.50	984
D	8.75	222
E	8.90	225
F	17.10	435

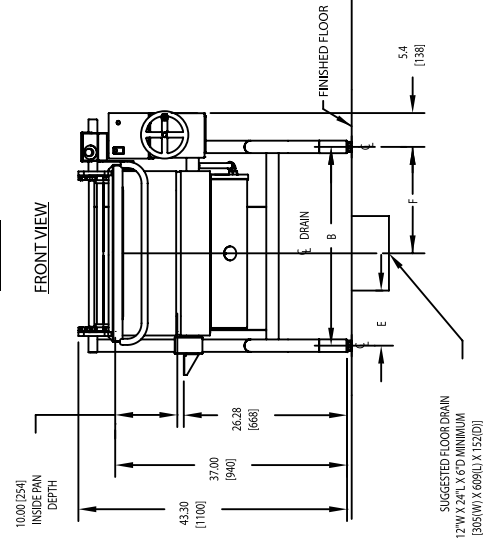
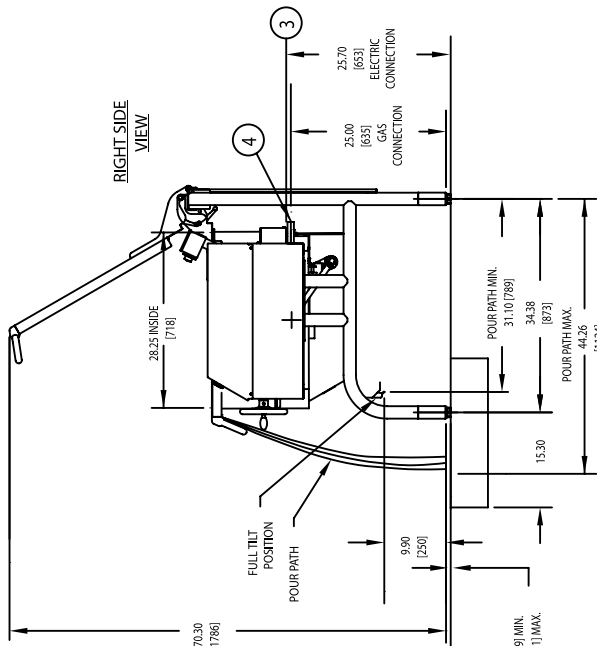
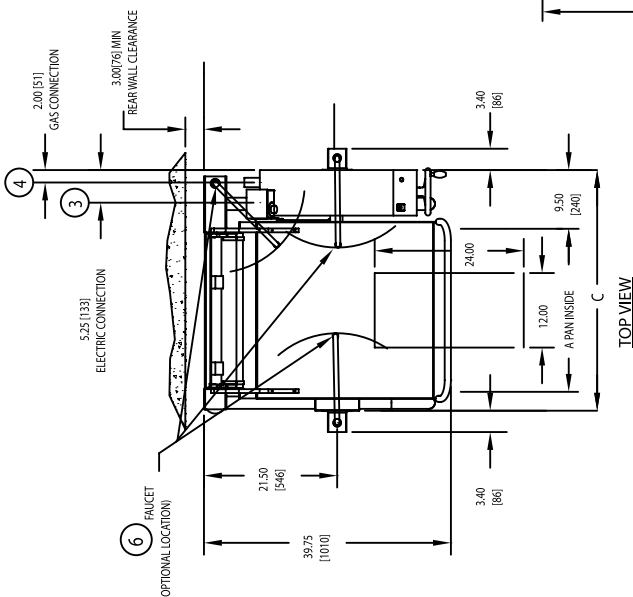


PERFORMANCE DATA		
MODEL	BPM-30G	BPM-40G
FIRING RATE BTU/HR	104,000	144,000
CAPACITY GALLONS	30	40
	LITERS	114

GAS FEED RATE: INCHES WATER COLUMN -RECOMMENDED INCOMING-	
NATURAL GAS	4.5" W.C. MIN. 14" W.C. MAX.
PROPANE GAS	11" W.C. MIN. 14" W.C. MAX.

NOTES:

1. DIMENSIONS IN BRACKETS [ ] ARE MM.
2. CASTERS OR FLANGED FEET AVAILABLE AT AN EXTRA COST.
3. ELECTRICAL CONNECTION: 0.875" DIA. (22) HOLE 115 V, 1 PH, 60 HZ, 5 AMPS.
4. GAS CONNECTION: 1/2" NPT.
5. ELECTRIC POWER NOT REQUIRED ON OPTIONAL STANDING PILOT MODELS (BPM-30GS & 40GS).
6. FAUCET BRACKET MAY BE INSTALLED ON LEFT OR RIGHT SIDE.
7. THE SIZE AND LOCATION OF DRAIN TROUGH ARE FOR REFERENCE ONLY. USER SHOULD VERIFY THE LOCATION AND PLACEMENT OF UNIT OVER TROUGH. PRODUCT TO BE POLISHED AND RELATED VARIABLES.
8. TETHER REQUIRED WITH CASTERS TO SECURE UNIT.



CLASSIC CONTROL



ADVANCED CONTROL



COOK2TEMP CONTROL



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## Submittal Sheet

01/09/2023

### ITEM# 59 - FLOOR TROUGH (1 EA REQ'D)

Eagle Group ASFT-2424-FG

Anti-Splash Floor Trough, 24"W x 24"D, yellow fiberglass subway-style grating with non-slip surface, 6" deep trough pan with built-in pitch toward drain, accommodates up to a 4" diameter drain pipe, stainless steel removable perforated basket, all-welded 14/304 stainless steel construction, NSF

The spec sheet for this item can be viewed on item 22)

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	1		NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.
Eagle Group	1		ADA-compliant grating

#### WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1									

#### WASTE

	INDIRECT SIZE	DIRECT SIZE
1		4"



## Submittal Sheet

01/09/2023

### ITEM# 60 - FLOOR TROUGH (1 EA REQ'D)

Eagle Group ASFT-2436-FG

Anti-Splash Floor Trough, 36"W x 24"D, yellow fiberglass subway-style grating with non-slip surface, 6" deep trough pan with built-in pitch toward drain, accommodates up to a 4" diameter drain pipe, stainless steel removable perforated basket, all-welded 14/304 stainless steel construction, NSF

The spec sheet for this item can be viewed on item 22)

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	1		NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.
Eagle Group	1		ADA-compliant grating

#### WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1									

#### WASTE

	INDIRECT SIZE	DIRECT SIZE
1		4"



***Submittal Sheet***

01/09/2023

**ITEM# 63 - SPARE NO.**

<Spare No.>



***Submittal Sheet***

01/09/2023

**ITEM# 64 - SPARE NO.**

<Spare No.>





**Submittal Sheet**

01/09/2023

**ITEM# 65 - BLAST CHILLER FREEZER, REACH-IN (1 EA REQ'D)**

American Panel AP12BCF110-3

HURRiCHILL™ Blast Chiller/Shock Freezer, Reach-in, self-contained, (24) 12" x 20" x 2.5" or (12) 18" x 26" pan capacity, 110 lbs. from 160° F to 38° F blast chill capacity/90 minutes, 90 lbs. 160° F to 0° F freeze capacity/240 minutes, 7" LCD touch screen controller with Quick Start & A La Carte functionality, (1) heated food probe, stainless steel interior & exterior, 6" stainless steel legs, 3 HP, UL CLASSIFIED EPH, cUL, ANSI/NSF

**ACCESSORIES**

Mfr	Qty	Model	Spec
American Panel	1		1 year parts & labor warranty standard on cabinet only
American Panel	1		5 year compressor warranty is standard, 1 year parts, labor not included
American Panel	1		Standard Refrigeration, R404a refrigerant
American Panel	1		208v/60/3-ph, 10.0 amps, 6' cord, NEMA L15-20P
American Panel	1		Drain line assembly
American Panel	1		Condensate evaporator
American Panel	1		Wi-Fi communication

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1									3		
2	208	60	3	Cord & Plug		L15-20P	10				



Project Name: \_\_\_\_\_

Item #: \_\_\_\_\_

Quantity: \_\_\_\_\_

**Type: Blast Chiller/Shock Freezer (Self-Contained)****Model: AP12BCF110-3****HURRICHILL****Standard Features****PERFORMANCE:**

- Blast chilling (soft or hard) lowers the food core temperature from 160°F to 38°F within 90 minutes.
- Shock freezing lowers the food core temperature from 160°F to 0°F within 4 hours.
- *Chilling times will vary somewhat, depending on the food quantity, initial temperature, density, moisture content, specific heat, and type of container.*
- The airflow has a high velocity, indirect pattern designed to cool all levels at identical rates.
- Time/temperature chilling rates meet or exceed all FDA, NSF, and state regulations.

**TOUCHSCREEN CONTROLS:**

- 7" glove-safe capacitive touchscreen
- Easily readable from across the kitchen
- User friendly interface and quick access to all functions
- Quick-start button for one touch operation
- Capable of automated defrost and sanitation cycles
- HACCP logger, data download via optional Wifi card or USB port
- Available cycles - Soft Chill, Hard Chill, Shock Freeze, Quick Start
- One core temperature probe is provided

**CABINET CONSTRUCTION:**

- Constructed of polished type 304 stainless steel,
- 2" of CFC-free, high density polyurethane insulation.
- Interior has a mirror finish and fully rounded interior bottom
- Removable magnetic door gasket.
- Door is hinged on the operator's left
- 6' long four wire cord set with NEMA L15-20P plug provided
- 6" height adjustable legs
- Clearance: 32" at the front for door opening, 5" at the back, 3" on either side

**REFRIGERATION SYSTEM:**

- Self-contained refrigeration system
- E-coated (electro-deposition coated) multiple circuits evaporator designed specifically for blast chilling operation
- Wash-down type motorized impeller fans with sealed ball bearing and overload protection
- Hinged swing out vent panel for easy evaporator cleaning

**Warranty**

The warranty covers all parts found to be defective and the labor required to replace them for a period of one year from the date of shipment. The compressor only is covered for an additional period of four years, as a part only, no labor.  
Warranty excludes food probes.



**Overview:** American Panel's blast chillers and shock freezers are the perfect product for all of your chilling and freezing needs. These units are completely self contained and ready for plug and play operation. The HURRICHILL series of chillers also features a consolidated evaporator fan assembly. This places all of the components within the cabinet, which greatly reduces the overall footprint of the unit. American Panel quality and precision in a flexible format to fit your needs.

**Capacity**

- (24) 12"x20"x2.5" pans
- (12) 18"x26" sheet pans

**Product Yield**

- 110 lbs. - 160°F - 38°F in 90 minutes
- 132 lbs. - 160°F - 38°F in 120 minutes
- 66 lbs. - 160°F - 0°F in 240 minutes

**Certifications**

Blast Chiller/Shock Freezer (Self-Contained) - AP12BCF110-3

**Controller**



**Soft Chilling:** The air temperature is held in the range of 28°F to 35°F, ideal for delicate food items. The chilling cycle is completed when the food core temperature reaches 38°F.

**Hard Chilling:** The air temperature is lowered to and held within a range of 0°F to 10°F. When the food core temperature reaches 60°F, the air temperature rises to a range of 28°F to 35°F. The chilling cycle is completed when the food core temperature reaches 38°F.

**Shock Freeze:** The air temperature is lowered to and held within a range of -25°F and -15°F. The freezing cycle is completed when the food core temperature reaches 0°F.

**Quick Start:** Programmable single touch button to start a cycle. Used for the most popular settings for the customer. This allows for starting any chilling or freezing cycle with one touch.

**ADDITIONAL FEATURES:**

**Thawing (Optional):** Air temperature is carefully monitored and alternates between gentle heat and refrigeration to safely thaw the product.

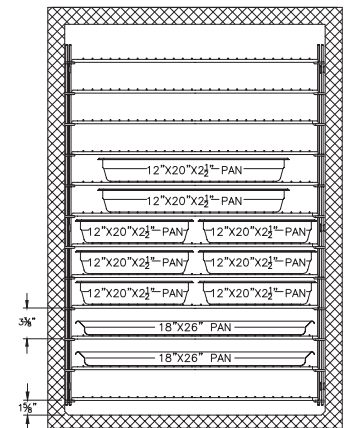
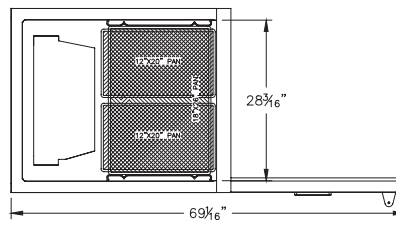
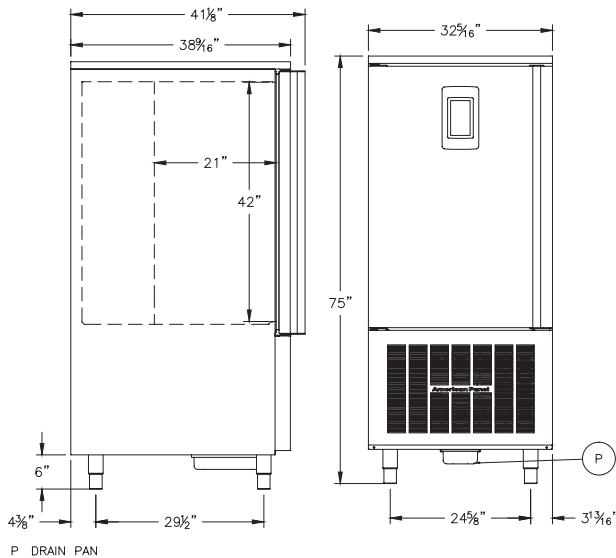
**Holding:** At the end of any cycle, the unit will automatically switch to a holding mode which will keep the food at holding temperature until the cycle is stopped.

**Defrost:** Air defrost cycle is included within the unit's controller programming.

**Product Names:** Store up to 150 product names.

**Dimensions**

**INSTALLATION:** A detailed installation manual is provided. It must be carefully followed to ensure proper operation and to protect your rights under the warranty.



COMPARTMENT SECTION

REQUIRED CLEARANCES:  
5" AT THE BACK  
3" ON EITHER SIDE

**Specifications**

Model	Electrical						Compressor HP	Ship Weight
	V	Hz	PH	A	MCA	MOPD		
AP12BCF110-3	208	60	3	10.0	20	20	3.0	770 lbs.

**Options and Accessories**

- Cabinet Sanitation:** The automated sanitation cycle and odor control system keeps the chiller fresh and free of contamination. The patented technology creates PhotoPlasma® by recirculating air inside the blast chiller over a UV light. This PhotoPlasma® treats the air and surfaces inside the blast chiller to neutralize odors at their sources and to inhibit the growth of contamination. The system is not intended to sanitize food.
- USB HACCP Interface:** Use a standard USB thumb drive to easily download HACCP data. The information recorded includes date, time, cycle identification, recipe name, and product core temperature at prescribed intervals.
- Wi-Fi Connectivity:** Supported functions include peer-to-peer connectivity, remote monitoring over the local network, HACCP data download and alarm notifications via e-mail.
- Extra Food Probes:** One probe is standard, up to three additional probes can be provided.
- Heavy duty casters,** Heavy duty 5" casters, two with brakes
- Condensate evaporator:** The optional condensate evaporator is provided with a cord and plug NEMA 5-15P and requires a separate 120V/60Hz/1Ph power supply. The condensate evaporator will mount onto the left side of the unit and extends the width of the unit by 8".
- Bumper Rail:** 2" wide bumper rail mounted on either side of the unit. The center line of the bumper rail will be located at 36" AFF.
- Thaw Package:** to include a thaw probe, sanitary bit, and a battery operated drill (automatic thawing requires probing the frozen product).
- Probe holder for liquids:** The probe support will clip onto the edge of a standard steam table pan.
- Drain line assembly:** By default the unit is provided with a drain pan that needs to be emptied daily. The drain line assembly will make it easy to hook up the unit to a floor sink.

Blast Chiller/Shock Freezer (Self-Contained) - AP12BCF110-3



## Submittal Sheet

01/09/2023

### ITEM# 66 - PLANETARY MIXER (1 EA REQ'D)

Hobart HL800-2STD

Legacy Planetary Mixer, 80 quart, (4) fixed speeds plus stir speed, gear-driven transmission, 20-Minute SmartTimer™, power bowl lift, stainless steel bowl guard, stainless steel bowl, "B" beater, "ED" dough hook, bowl truck, 3.0 HP, 380-460v/50/60/3-ph (US & Export configuration)

#### ACCESSORIES

Mfr	Qty	Model	Spec
Hobart	1		Standard warranty: 1-Year parts, labor & travel time during normal working hours within the USA
Hobart	1	TRUCK-HL1486	Legacy® Mixer Bowl Truck, aluminum, for use with 60, 80 & 140 quart mixers

### ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	380-460		3	Direct							



Project \_\_\_\_\_  
 AIA # \_\_\_\_\_ SIS # \_\_\_\_\_  
 Item # \_\_\_\_\_ Quantity \_\_\_\_\_ C.S.I. Section 114000



## HL800 LEGACY+ 80-Quart Maximum Heavy-Duty Mixer



### SPECIFIER STATEMENT

Specified mixer will be an NSF rated 80-quart maximum heavy-duty, all-purpose mixer with Hobart PLUS System, four fixed speeds plus a stir speed. Mixer has 3 HP output at the planetary shaft and gear transmission. Features include automatic time recall, swing-out bowl, Shift-on-the-Fly™ controls and power bowl lift. Mixer finished with a metallic gray hybrid powder coat and has a stainless steel bowl guard.

### MODEL

- HL800** 80-Quart Maximum Heavy-Duty Mixer
- HL800C** 80-Quart Maximum Heavy-Duty Mixer with Maximum Security Correctional Package

### STANDARD FEATURES

Features in bold are exclusive to Hobart

- + **PLUS System**
  - **VFD*advantage* variable frequency drive**
  - **Maximum capacity overheat protection**
  - **Reinforced planetary shaft system**
- + **Triple interlock system with MagnaLock technology**
- + Heavy-duty 3 HP motor
- + Gear transmission
- + Four fixed speeds, plus stir speed
- + **Shift-on-the-Fly™ controls**
- + Soft start agitation technology
- + **20-minute SmartTimer™**
- + Automatic time recall
- + Large, easy-to-reach controls
- + **Single point bowl installation**
- + **Ergonomic swing-out bowl**
- + Power bowl lift
- + Open base
- + Metallic gray hybrid powder coat finish
- + Stainless steel removable bowl guard
- + FastStop

### ACCESSORY PACKAGE

Featuring Hobart Quick Release™ Agitators

- HL800-1STD Standard Accessory Package includes:
  - + 80-quart stainless steel bowl
  - + 80-quart "B" beater
  - + 80-quart "ED" dough hook
  - + 80-quart bowl truck

HL800 LEGACY+ 80-QUART MAXIMUM HEAVY-DUTY MIXER

Approved by \_\_\_\_\_ Date \_\_\_\_\_ Approved by \_\_\_\_\_ Date \_\_\_\_\_



## HL800 LEGACY+ 80-Quart Maximum Heavy-Duty Mixer

### SOLUTIONS/BENEFITS

#### PERFORMANCE

##### VFD*advantage* Variable Frequency Drive

- + Direct drive system
- + Ensures superior mixing consistency, motor protection and long life

##### Quick Release™ Agitators

- + Eliminates the up/down play of bayonet-style agitators
- + Consistent agitator-to-bowl ratio delivers superior mixing performance

##### Five Mixing Speeds

- + Can handle virtually any mixing job
- + Includes stir speed

##### Reinforced Planetary Shaft System

- + Rugged durability under the most challenging mixing conditions

#### EASE OF USE

##### Ergonomic Swing-Out Bowl

- + Easily swing bowl to the side to remove/add ingredients
- + Adds convenience and saves time

##### Single-Point Bowl Installation

- + Easy-to-mount bowl uses only one point to install
- + Reduces risk of spills, speeds up mixing process

##### Power Bowl Lift

- + Electronic, smoothly moves bowl into mixing position

##### Shift-on-the-Fly™ Controls

- + Allows safe, convenient speed changes while the motor is running
- + Pulse and jog as needed

##### 20-Minute SmartTimer™

- + Automatic recall of time and speed

#### SANITATION & CLEANING

##### Stainless Steel Removable Bowl Guard

- + Easy to remove without tools for cleaning
- + Dishwasher-safe for easy cleaning and sanitizing

##### Soft Start Agitation Technology

- + Gradually delivers electricity to the mixer
- + Minimizes the risk of ingredient splash out

#### OPERATOR ASSURANCE

##### Triple Interlock System with MagnaLock Technology

- + Prevents mixer from operating unless the bowl is fully up and locked in place and the bowl guard is secured

##### FastStop

- + VFD*advantage* brings all moving parts to a complete stop in less than 3 seconds

### HL800 MIXER CAPACITY CHART

Recommended Maximum Capacities – dough capacities based on 70°F water and 12% flour moisture.

Product	Agitators Suitable for Operation	HL800
Capacity of Bowl (Qt. Liquid)		80
Egg Whites	D	2 qt.
Mashed Potatoes	B & C	60 lb.
Whipped Cream	D or C	16 qt.
Cakes	B	100 lb.
Cookies, Sugar	B	60 lb.
Dough, Bread or Roll ★ (Lt.-Med.) 60% AR	ED	170 lb. ▲
Dough, Heavy Bread 55% AR ★	ED	140 lb. ▲
Dough, Thin Pizza 40% AR ★ (max. mix time 5 min.)	ED	85 lb. ●
Dough, Thick Pizza 60% AR ★	ED	155 lb. ■
Dough, Whole Wheat 70% AR	ED	150 lb. ■
Icing, Fondant	B	65 lb.
Icing, Marshmallow	C or I	10 lb.
Pasta, Basic Egg Noodle (max. mix time 5 min.)	ED	65 lb. ●

**Note:** % AR (% Absorption Ratio) – Water weight divided by flour weight. Capacity depends on moisture content of dough. Above capacities based on 12% flour moisture at 70°F water temperature.

● 1st Speed

■ 2nd Speed

▲ 3rd Speed

★ If high gluten flour is used, reduce above dough batch size by 10%.

2nd speed should never be used on 50% AR or lower products.

Use of ice requires a 10% reduction in batch size.

1 gallon of water weighs 8.33 lbs.





## HL800 LEGACY+ 80-Quart Maximum Heavy-Duty Mixer

### SPECIFICATIONS

**Motor:** 3 HP high torque motor.

200-240/50/60/3 – 12.0 Amps

380-460/50/60/3 – 6.0 Amps

**Electrical:** 200-240/50/60/3, 380-460/50/60/3 – UL Listed.

**Controls:** Magnetic contactor and thermal overload protection. Internally sealed “Start-Stop” and Power Bowl Lift push buttons. Reduced voltage pilot circuit transformer is supplied for 380-460/50/60/3 machines. A 20-minute SmartTimer™ is standard. SmartTimer™ includes:

- **Automatic Time Recall**, which remembers the last time set for each speed.
- **Transmission:** A rated 10 HP poly-V belt transfers power from motor to input shaft then geared down to desired reduction with a constant gear mesh. Gears and shafts are heat-treated hardened alloy steel along with anti-friction ball bearings. Circulating oil and grease lubricants furnished to all gears and shafts.

Speeds	Agitator (RPM)
Stir	27
First	55
Second	96
Third	183
Fourth	322

**Bowl Guard:** Heavy-duty stainless steel wire front and solid rear portion. Front portion of guard rotates easily to add ingredients and install or remove agitator. It detaches in seconds for cleaning in dishwasher or sink. Rear portion of guard can be quickly cleaned in position. Guard must be in closed position before mixer will operate. Bowl support interlock provides further protection.

**Power Bowl Lift:** Powered by an electric motor, the bowl may be raised or lowered by fingertip control through the conveniently located switch. Bowl will remain in position until switch is activated.

**Stir-on-Lift Feature:** Allows the agitator to run in Stir Speed while the mixer bowl is being raised. Once the bowl is in the raised position, the mixer automatically shifts into the preselected speed.

**Warranty:** Unit has full one-year warranty on parts, labor and mileage against manufacturer's defects. Service contracts are available.

**Finish:** Metallic gray hybrid powder coat finish.

**Footpads:** Neoprene footpads are standard.



### Attachments and Accessories:

The following are available at extra cost:

Attachment / Accessory	Device #
Stainless Steel Bowl	BOWL-HL80
“B” Flat Beater	BBEATER-HL80
“C” Wing Whip	CWHIP-HL80
“D” Wire Whip	DWHIP-HL80
“ED” Dough Hook	EDDOUGH-HL80
“P” Pastry Knife	PPASTRY-HL80
“I” Heavy Duty Wire Whip	IWIRE-HL80
Bowl Splash Cover (lexan)	SPLASH-LEX080
Bowl Scraper	SCRAPER-HL80
Ingredient Chute	CHUTE-LMV
Bowl Truck	TRUCK-HL1486
Bowl Extension Ring	EXTEND-SST80G
40 Quart Accessories	See HL400 spec sheet
60 Quart Accessories	See HL600 spec sheet

### Plugs and Receptacles:

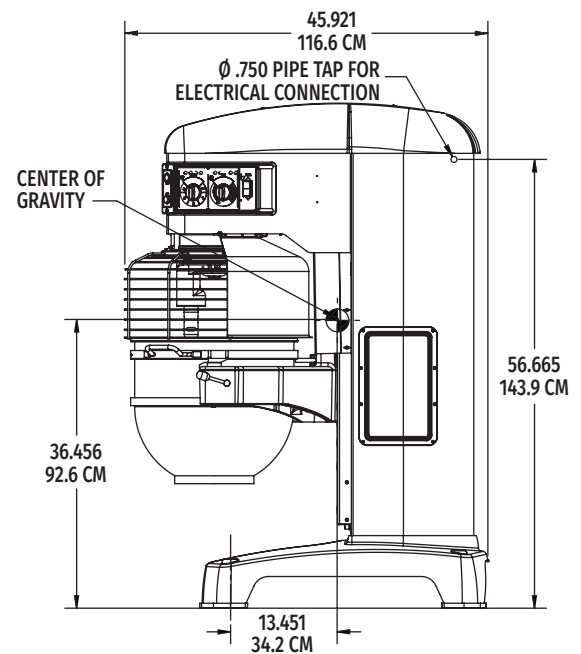
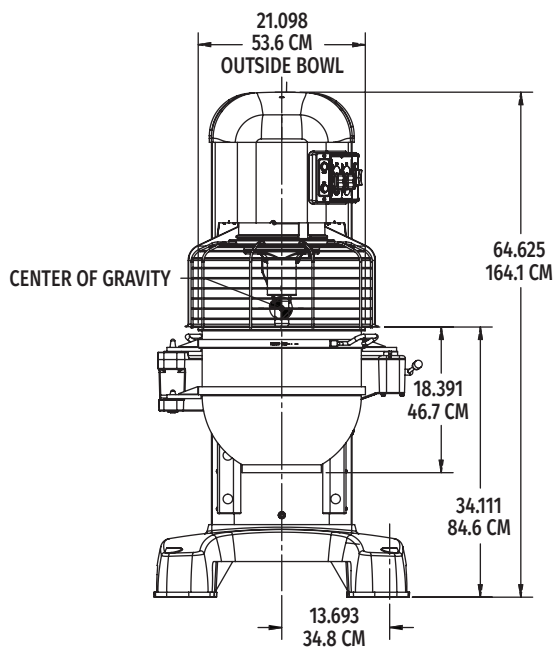
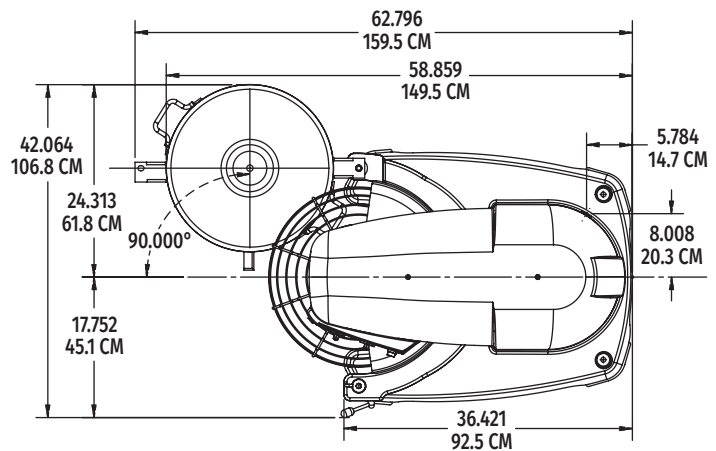
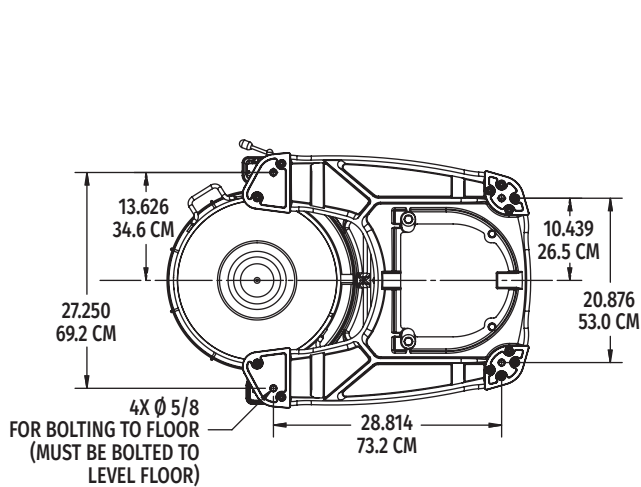
*Dependent on local power codes; cords not provided*

	Machine Voltages	
	HL800	380-460
<b>Service Current Requirement if Plug Connected</b>	230/60/3	460/60/3
	20 Amp.	20 Amp.
<b>Terminal Designation of Plug</b>	3 Pole 4 Wire Grounding	3 Pole 4 Wire Grounding
<b>NEMA Plug Configuration</b>	L15-20P	L16-20P
<b>Plug Configuration</b>		
<b>Molded Plug on Cord</b>	No	No
<b>Plug - Straight/Angle</b>	Straight	Straight
<b>NEMA Receptacle or Connector Configuration</b>	L15-20R	L16-20R
<b>Power Cord Included</b>	No	No



## HL800 LEGACY+ 80-Quart Maximum Heavy-Duty Mixer

### DETAILS AND DIMENSIONS



**WARNING:** Electrical and grounding connections must comply with the applicable portions of the National Electrical Code and/or other codes in force.

**NOTE:**  
Standard Model:  
Net Weight (Bowl Included): 1375 lbs. (624 kg)  
Bowl Weight: 55.4 lbs. (25.1 kg) - Ref



# Legacy Mixer Accessories & Applications



## D Wire Whip

Good for heavy whipping. Applications include light creaming and beating, potatoes, butter, mayonnaise, and light icing. Use in 1st or 2nd speed for heavier products such as potatoes or in 3rd or 4th speed for lighter products like icing.



## C Wing Whip

Best for maximum blending of air into light products. Applications include whipping cream, beating egg whites, light icings and meringues. Use in 3rd or 4th speed for best results.



## E Dough Hook

Used for mixing, stretching, and folding most bread, roll, and pizza doughs. Also good for lighter breads.



## ED Dough Hook

Used for mixing, stretching, and folding most bread, roll, and pizza doughs. Use in 1st, 2nd, or 3rd speed for 2 and 3 speed mixers. Use in 1st, 2nd, or 3rd speed for 4 speed mixers.



## I Heavy-Duty Wire Whip

Great for heavy whipping. Applications include sponge cakes and light marshmallow. Use in 3rd or 4th speed for best results.



## P Pastry Knife

Combines shortening with flour, and is ideal for light pastry shells, flaky pie doughs, and similar mixes. For stirring, use low speeds, for cutting use medium speeds.



## Bowl Truck

Use to remove the bowl from the mixer to desired location. The bowl truck saves time, reduces handling, and improves work flow.



## Bowl Adapter

Use to remove a 40 or 60 qt. bowl with a larger bowl truck with this adapter.



## Ingredient Chute

Used for adding ingredients while mixing. The ingredient chute attaches to the wire cage on the bowl guard.



## Mixer Table

For use when mixer will not be put on a counter. There are also prongs to place accessories.



## Bowl Scraper

Used for scraping the sides of the bowl after operation.



## B Flat Beater

Great for mashing potatoes, mixing cakes, batters, icings and creaming/uniform dispersion of ingredients. Use 1st speed for starting and medium speed for finishing.



# Legacy® HL200 Maximum Heavy-Duty mixer

The only solution for kitchens that mix challenging heavy-duty doughs or batters, may mix continuously batch after batch, and require superior mixing performance time after time.



## Variable Frequency Drive (VFD) ☆ 📊

All-gear, direct drive system ensures superior mixing consistency, motor protection and 3 times longer life.\*

## Four mixing speeds 📊

Includes ultra-slow stir speed for maximum convenience.

## Quick-Release™ agitators ☆ 🖱️

Changing is fast and easy. Pin locks agitator to shaft, eliminating the up/down play of bayonet-style agitators. The consistent agitator-to-bowl ratio, delivers **superior mixing performance**.

## Removable bowl guard 💧

Easy to remove without tools for cleaning and sanitizing.

## Ergonomic bowl lift 🖱️

Smoothly moves the bowl into mixing position.

## Triple interlock system ☆ !

Prevents mixer from operating unless the bowl is fully up and locked in place and the bowl guard is secured.

## Soft start 💧

Minimizes risk of ingredient splash-out for less cleanup time.

## Shift-on-the-Fly™ technology ☆ 🖱️

No need to stop the machine to change speeds.

## SmartTimer™ feature 🖱️

Automatically recalls the last time set for each speed, making it easy to mix multiple batches of the same product.

## Single-point bowl installation ☆ 🖱️

Simplifies attaching the bowl to the mixer.

## Swing-out bowl ☆ 🖱️

Patented feature adds convenience and saves time.

## Hobart Ownership Benefits

- ☆ = Hobart Exclusive Benefits
- 💧 = Sanitation & Cleaning
- 📊 = Performance
- ! = Operator Assurance
- 🖱️ = Ease of Use

\*Versus standard heavy-duty mixer products



# HOBART

hobartcorp.com  
1-888-4HOBART (1-888-446-2278)  
1-937-332-3000

Hobart  
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Troy, Ohio 45374

ITW FOOD EQUIPMENT GROUP

F40934 (04/19)

Legacy is a registered trademark of ITW Food Equipment Group.  
Centerline, GearSafe, Shift-on-the-Fly, Quick-Release and SmartTimer are trademarks of ITW Food Equipment Group.



## Submittal Sheet

01/09/2023

### ITEM# 67 - WORK TABLE, STAINLESS STEEL TOP (4 EA REQ'D)

Eagle Group T3072SE-BS

Spec-Master® Series Work Table, 72"W x 30"D, 4-1/2"H backsplash, 14/300 series stainless steel top, rolled front edge, adjustable 18/300 series stainless steel undershelf with marine edge, Uni-Lok® gusset system, (4) stainless steel legs & adjustable bullet feet, NSF

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	4	E101A	Turn down back of splash per table with Z clip
Eagle Group	4	E23	Sink, 16" x 20" x 14" bowl, for 30"W tables, complete with faucet & basket drain (specify location)
T&S Brass	4	5F-4CW10	Equip Workboard Faucet, 4" OC deck mount, 10" swing nozzle, quarter-turn ceramic cartridge, 4" wrist action handles, low lead, ADA Compliant
T&S Brass	4	B-3952-01	Waste Valve, twist handle, 3-1/2" sink opening, 2" drain outlet with overflow assembly (replaces B-3917-01)
Eagle Group	4	-TB	Twist bracket, per drain
Eagle Group	4		add overflow hole punch
Eagle Group	4	E32	Can opener hole with under table support (specify location)

### WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1	1/2"			1/2"					
2									

### WASTE

	INDIRECT SIZE	DIRECT SIZE
1		
2	1-1/2" to 2"	

#### PLUMBING 2 REMARKS

2" NPT Male Thread, 1-1/2 NPT Female Thread Outlet



Profit from the Eagle Advantage®

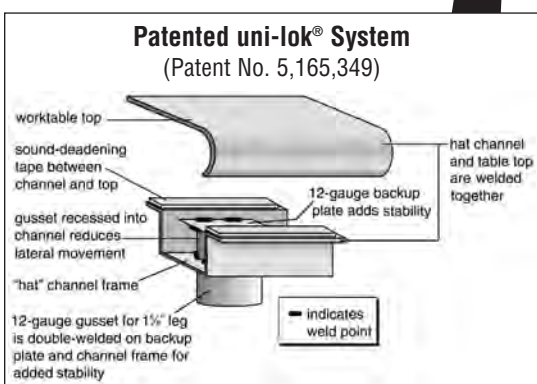
## Specification Sheet

### Short Form Specifications

Eagle worktables, Spec-Master® series, model \_\_\_\_\_.  
Top constructed of 14 gauge 300 series stainless steel with 1½" roll on front, 4½" backsplash, and sides turned down 90°. Adjustable undershelf constructed of 18 gauge 300 series stainless steel with marine edge. Top reinforced with stainless steel hat channels and sound deadened. Constructed with uni-lok® patented gusset system with the gussets recessed into the hat channels to reduce lateral movement. 1½"-diameter stainless steel legs, with stainless steel gussets and 1" stainless steel adjustable bullet feet.



worktable with backsplash  
and adjustable undershelf



### EAGLE GROUP

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Foodservice Division: Phone 800-441-8440

MHC/Retail Display Divisions: Phone 800-637-5100

For custom configuration or fabrication needs, contact our SpecFAB® Division.

Phone: 302-653-3000 • Fax: 302-653-2065 • e-mail: quotes@eaglegrp.com

Spec sheets available for viewing, printing or downloading from our online literature library at [www.eaglegrp.com](http://www.eaglegrp.com)

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Item No.: \_\_\_\_\_

Project No.: \_\_\_\_\_

S.I.S. No.: \_\_\_\_\_

## Worktables with Backsplash and Stainless Steel Base with Undershelf —Spec-Master® Series

### MODELS:

- |                                     |                                      |                                      |                                      |
|-------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|
| <input type="checkbox"/> T2424SE-BS | <input type="checkbox"/> T24108SE-BS | <input type="checkbox"/> T3072SE-BS  | <input type="checkbox"/> T3660SE-BS  |
| <input type="checkbox"/> T2430SE-BS | <input type="checkbox"/> T24120SE-BS | <input type="checkbox"/> T3084SE-BS  | <input type="checkbox"/> T3672SE-BS  |
| <input type="checkbox"/> T2436SE-BS | <input type="checkbox"/> T24132SE-BS | <input type="checkbox"/> T3096SE-BS  | <input type="checkbox"/> T3684SE-BS  |
| <input type="checkbox"/> T2448SE-BS | <input type="checkbox"/> T24144SE-BS | <input type="checkbox"/> T30108SE-BS | <input type="checkbox"/> T3696SE-BS  |
| <input type="checkbox"/> T2460SE-BS | <input type="checkbox"/> T3030SE-BS  | <input type="checkbox"/> T30120SE-BS | <input type="checkbox"/> T36108SE-BS |
| <input type="checkbox"/> T2472SE-BS | <input type="checkbox"/> T3036SE-BS  | <input type="checkbox"/> T30132SE-BS | <input type="checkbox"/> T36120SE-BS |
| <input type="checkbox"/> T2484SE-BS | <input type="checkbox"/> T3048SE-BS  | <input type="checkbox"/> T30144SE-BS | <input type="checkbox"/> T36132SE-BS |
| <input type="checkbox"/> T2496SE-BS | <input type="checkbox"/> T3060SE-BS  | <input type="checkbox"/> T3648SE-BS  | <input type="checkbox"/> T36144SE-BS |

### Tabletop

- Patented uni-lok® gusset system (patent #5,165,349): gussets are recessed into hat channel, reducing lateral movement.
- Top reinforced with welded-on hat channel.
- Sound-deadened between top and channels.
- 4½" (114mm)-high 90° backsplash with 1" (25mm) turn at 90°.
- 1½" (38mm)-diameter 180° rolled edge on front. Ends are turned down 90°, providing for flush installations when required.
- 14 gauge 300 series polished stainless steel.

### Adjustable Undershelf

- Heavy gauge stainless steel.
- Gusset welded to each corner.
- Heavy duty marine edge design.

### Legs—1½" (41mm)-diameter

- Tables 96" (2438mm) and longer come with six legs or more.
- Heavy gauge stainless steel.
- 1" (25mm) adjustable stainless steel feet.

### Options / Accessories

- |  |   |
|--|---|
| <input type="checkbox"/> Drawer                              | <input type="checkbox"/> Duplex receptacles       |
| <input type="checkbox"/> Lock                                | <input type="checkbox"/> Pot rack                 |
| <input type="checkbox"/> Casters                             | <input type="checkbox"/> Sink                     |
| <input type="checkbox"/> Stainless steel bullet feet         | <input type="checkbox"/> Additional undershelf    |
| <input type="checkbox"/> Overshelves                         | <input type="checkbox"/> Stabilizer Bar (for 30"- |
| <input type="checkbox"/> Power strip (for material handling) | and 36"-wide tables)                              |

### Certifications / Approvals



### AUTOQUOTES



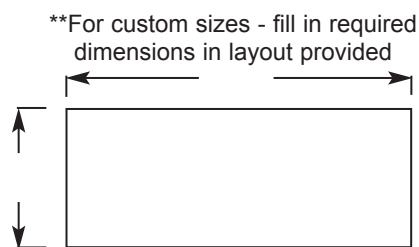




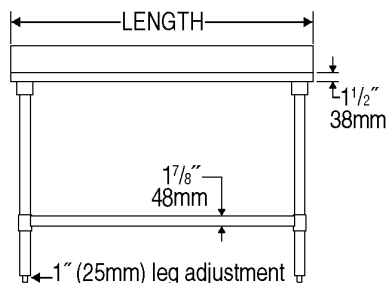
Profit from the Eagle Advantage®

Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

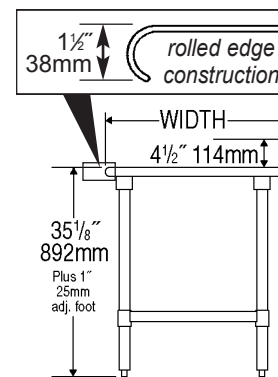
## Worktables with Backsplash and Stainless Steel Base with Undershelf—Spec-Master® Series



TOP VIEW



FRONT VIEW



SIDE VIEW

model #	# of legs	width		length		weight	
		in.	mm	in.	mm	lbs.	kg
T2424SE-BS	4	24"	610	24"	610	47	21.3
T2430SE-BS	4	24"	610	30"	762	53	24.0
T2436SE-BS	4	24"	610	36"	914	58	26.3
T2448SE-BS	4	24"	610	48"	1219	69	31.3
T2460SE-BS	4	24"	610	60"	1524	80	36.3
T2472SE-BS	4	24"	610	72"	1829	94	42.6
T2484SE-BS	4	24"	610	84"	2134	107	48.5
T2496SE-BS	6	24"	610	96"	2438	125	56.7
T24108SE-BS	6	24"	610	108"	2743	156	70.3
T24120SE-BS	6	24"	610	120"	3048	169	76.7
T24132SE-BS	8	24"	610	132"	3353	183	83.0
T24144SE-BS	8	24"	610	144"	3658	196	88.9
T3030SE-BS	4	30"	762	30"	762	55	24.9
T3036SE-BS	4	30"	762	36"	914	58	26.3
T3048SE-BS	4	30"	762	48"	1219	77	34.9
T3060SE-BS	4	30"	762	60"	1524	89	40.4
T3072SE-BS	4	30"	762	72"	1829	103	46.3
T3084SE-BS	4	30"	762	84"	2134	119	54.0
T3096SE-BS	6	30"	762	96"	2438	143	64.9
T30108SE-BS	6	30"	762	108"	2743	165	74.4
T30120SE-BS	6	30"	762	120"	3048	187	84.8
T30132SE-BS	8	30"	762	132"	3353	207	93.9
T30144SE-BS	8	30"	762	144"	3658	228	103.4
T3648SE-BS	4	36"	914	48"	1219	85	38.6
T3660SE-BS	4	36"	914	60"	1524	99	44.9
T3672SE-BS	4	36"	914	72"	1829	117	53.1
T3684SE-BS	4	36"	914	84"	2134	135	61.2
T3696SE-BS	6	36"	914	96"	2438	145	65.8
T36108SE-BS	6	36"	914	108"	2743	186	84.4
T36120SE-BS	6	36"	914	120"	3048	211	95.7
T36132SE-BS	8	36"	914	132"	3353	238	108.0
T36144SE-BS	8	36"	914	144"	3658	263	119.3

### EAGLE GROUP

100 Industrial Boulevard, Clayton, DE 19938-8903 USA

Phone: 302-653-3000 • Fax: 302-653-2065

www.eaglegrp.com

Foodservice Division: Phone 800-441-8440

MHC/Retail Display Divisions: Phone 800-637-5100

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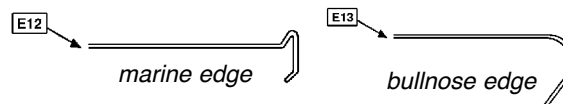
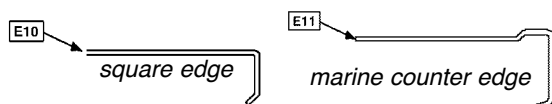
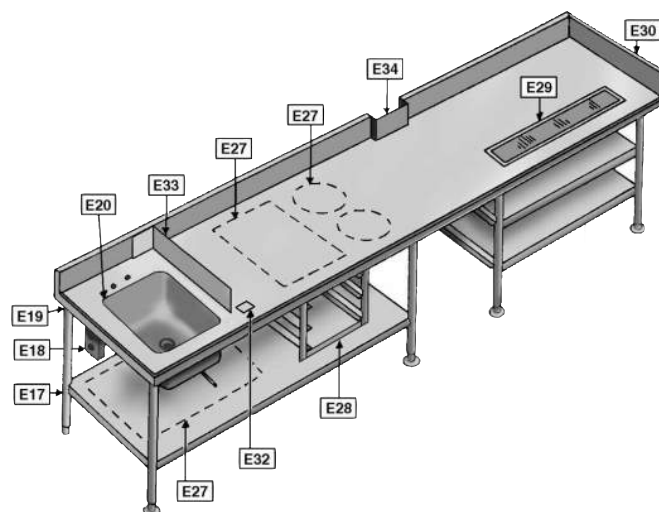
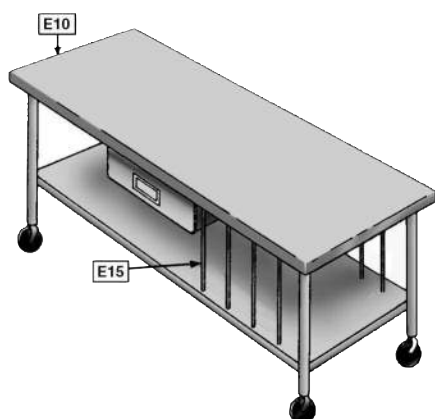
## Specification Sheet

Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

## Table Modifications and Accessories

For complete list of E# models and description, see chart below and chart on back page.

Refer to chart below for description of E# models.



model #	description
<b>E10</b>	Square edge table - front and/or rear
<b>E11</b>	Marine counter edge
<b>E12</b>	"V" type marine edge
<b>E13</b>	Bullnose edge
<b>300698</b>	Casters - 4" (102mm)-diameter with brake
<b>300699</b>	Casters - 4" (102mm)-diameter without brake
<b>317635</b>	Casters - 5" (127mm)-diameter with brake
<b>317636</b>	Casters - 5" (127mm)-diameter without brake
<b>300692</b>	Bullet feet - stainless steel
<b>301036</b>	Bullet feet - white metal
<b>300293</b>	Bullet feet - plastic

model #	description
<b>313835</b>	Stainless steel flanged bullet feet
<b>E15</b>	Vertical tray dividers - 4-section assembly, 3" on centers
<b>E17</b>	Special height legs
<b>E18*</b>	Duplex receptacle and mounting plate (under table)
<b>E18.1*</b>	Duplex receptacle in splash (requires at least 6"-high splash)
<b>E18.2*</b>	Pedestal duplex receptacle (top of table or overshell)
<b>E19</b>	Stainless steel gussets

### NOT PICTURED

model #	description
<b>606329</b>	Scrap chute, 6" (152mm)-diameter
<b>606331</b>	Knife rack (fits rolled rim, poly, and square edge tables)

\* For GFI receptacle, add "-GFI" to E number (example: E18.1-GFI).

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For custom configuration or fabrication needs, contact our **SpecFAB® Division**.  
 Phone: 302-653-3000 • Fax: 302-653-2065 • e-mail: quotes@eaglegrp.com

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### Certifications / Approvals



(fabricated to NSF-applicable standards)

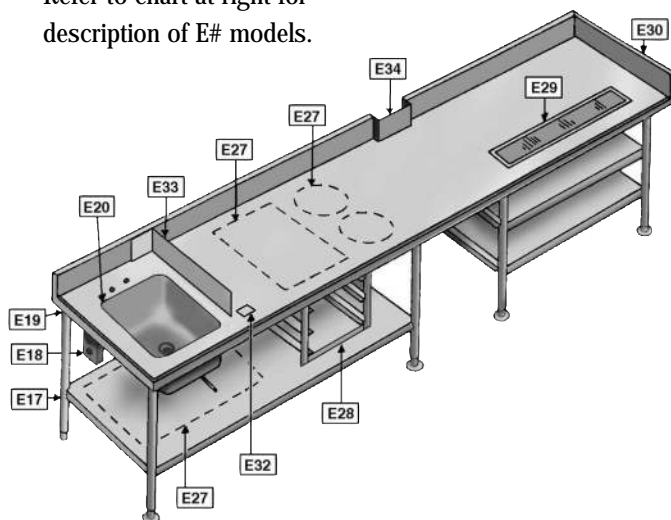




Profit from the Eagle Advantage®

## Table Modifications and Accessories

Refer to chart at right for description of E# models.



Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

### model # description

Sinks — complete with faucet and basket drain (Specify location)

**E20** - 10" x 14" x 9.5" bowl (254 x 356 x 241mm)

**E21** - 14" x 16" x 9.5" bowl (356 x 406 x 241mm)

**E22\*** - 16" x 20" x 8" bowl (406 x 508 x 203mm)

**E23\*** - 16" x 20" x 14" bowl (406 x 508 x 356mm)

**E24\*** - 18" x 20" x 14" bowl (457 x 508 x 356mm)

**E24A\*** - 20" x 20" x 14" (508 x 508 x 356mm)

**E25** - 24" x 24" x 14" bowl (610 x 610 x 356mm)

for 36" (914mm)-wide tables

**313304** T&S faucet upgrade - deck mount 4" (102mm) centers

**300720** Lever drain - 1.5" I.P.S. (38mm)

**300721** Lever drain - 2" I.P.S. (51mm)

**300722** Lever drain - 2" I.P.S. (51mm) with overflow

**341189\*\*** Twist handle drain - 1.5" I.P.S. (38mm)

**336002\*\*** Twist handle drain - 2" I.P.S. (51mm)

**341190\*\*** Twist handle drain - 2" I.P.S. (51mm) with overflow

**E27** Top cutout - square or round (Specify location)

**E28** Angle slides for pans, up to six pairs (Specify location and pan size)

**E29** Urn trough, 4.5" wide x 1.25" deep (114 x 32mm) with 1.5" (38mm) drain, complete with louvered grate. (Length must be maximum of 6" shorter than table. Specify location.)

**E30** End splash — per end (Specify end), all heights

**E31** 1.5" (38mm) rear upturn for undershelf

**E32** Can opener hole with under table support (Specify location)

**E33** Sink splash — single thickness, 4" tall (102mm)

**E34** Column cutout (Send floor plan/sketch)

### NOT PICTURED

#### model # description

**E35** 16 gauge s/s apron in front of sinks or cutouts

**E36** Fully welded - top, undershelf & legs

**E36A** Welded base only - undershelf & legs

**E37** NSF sprayed-on sound deadening up to 12' (3658mm)

**E37A** - for each additional foot

**E38-6\*\*\*** Cantilever mount up to 6' (1829mm)

**E38-12\*\*\*** Cantilever mount up to 12' (3658mm)

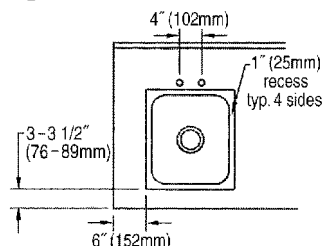
**E39** Enclosed backsplash

\* These sink bowls will not fit in a table any less than 30" (762mm) wide.

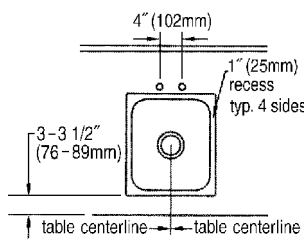
\*\* Optional twist drain brackets available for use with twist handle drains.

\*\*\* Applicable to wall mount shelves and pot racks.

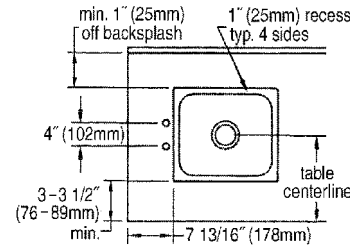
### Optional Sinks Built Into Tables – Standard Locations



sink on left/right side of table



sink on center of table



sink with faucet on end of table

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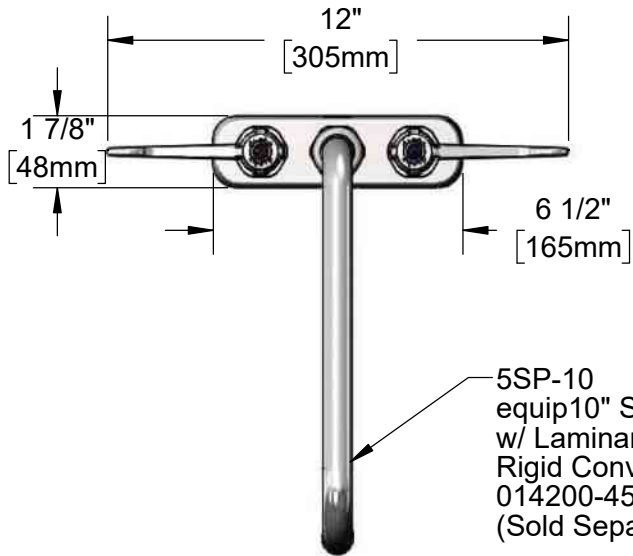
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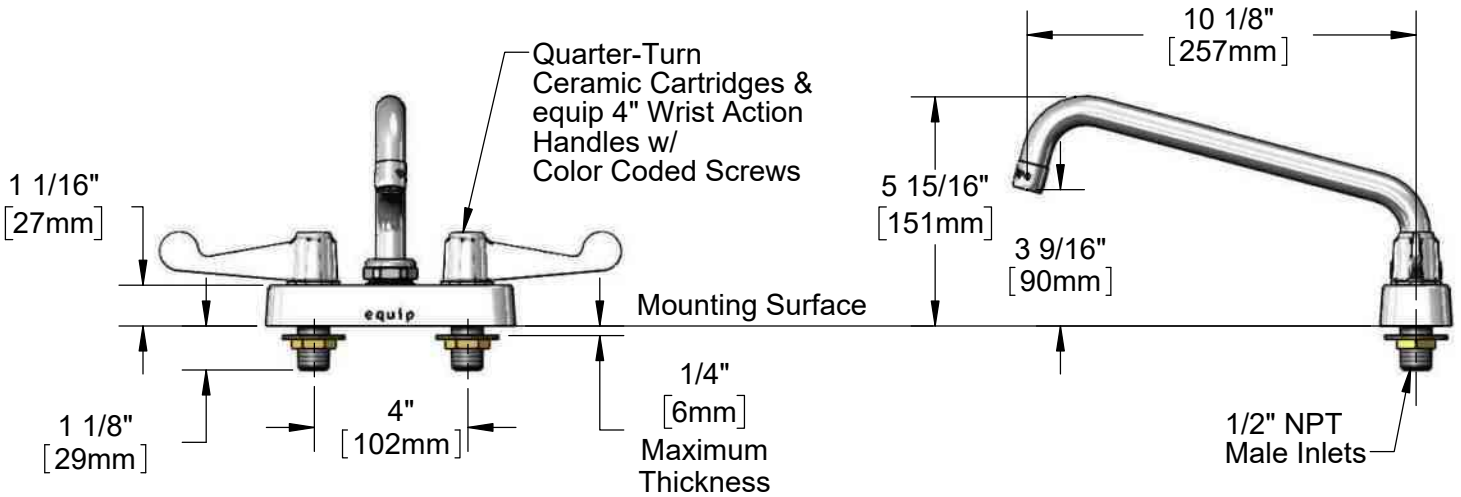
**ADA Compliant**

*This Space for Architect/Engineer Approval*

Job Name \_\_\_\_\_ Date \_\_\_\_\_  
 Model Specified \_\_\_\_\_ Quantity \_\_\_\_\_  
 Customer/Wholesaler \_\_\_\_\_  
 Contractor \_\_\_\_\_  
 Architect/Engineer \_\_\_\_\_



5SP-10  
 equip 10" Swing Nozzle  
 w/ Laminar Flow Device.  
 Rigid Conversion Requires  
 014200-45 Lock Washer  
 (Sold Separately)



Quarter-Turn  
 Ceramic Cartridges &  
 equip 4" Wrist Action  
 Handles w/  
 Color Coded Screws

**Rough-In Requirement:**  
 (2) Ø 1" [25mm] Mounting Holes

Model Number  
**5F-4CWX10**

Product Specifications:  
**4" Deck Mount Workboard Mixing Faucet w/ Quarter-Turn  
 Ceramic Cartridges, equip 4" Wrist Action Handles, equip 10"  
 Swing Nozzle & 1/2" NPT Male Inlets**

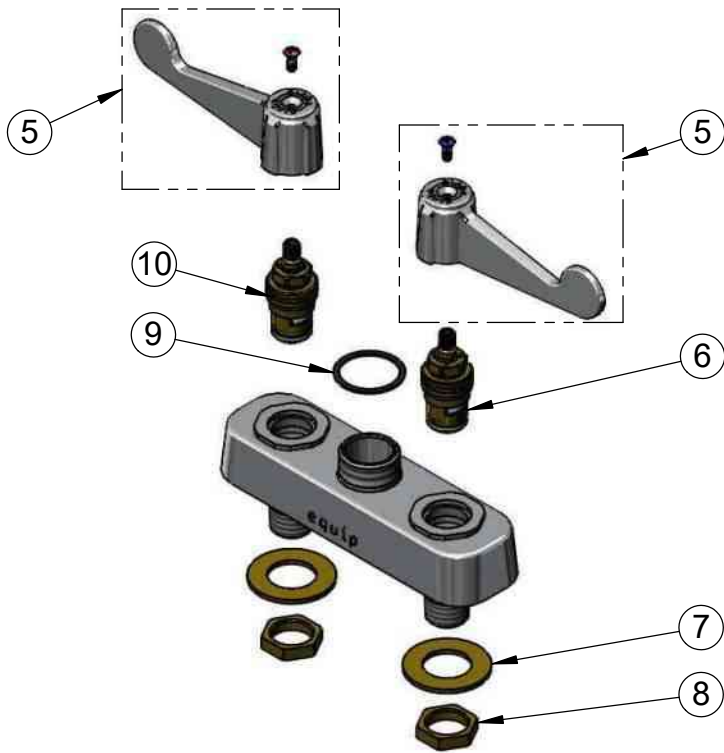
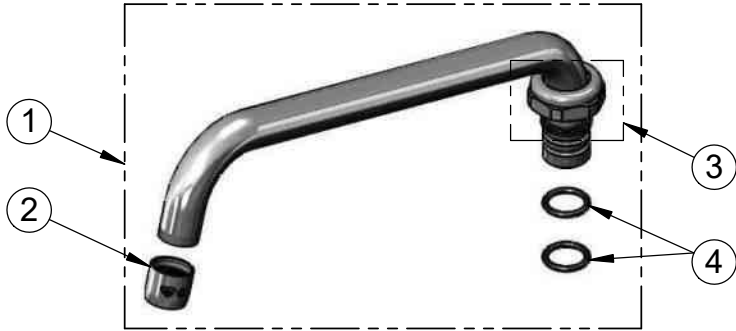
Product Compliance:  
 ASME A112.18.1 / CSA B125.1  
 NSF 61 - Section 9  
 NSF 372 (Low Lead Content)  
 ANSI A117.1 (ADA)

equip  
 Foodservice  
 Accessories

2 Saddleback Cove, P.O. Box 1088  
 Travelers Rest, South Carolina 29690  
 Phone: 800.891.4808 Fax: 800.868.0084  
 equip.tsbrass.com



ITEM NO.	SALES NO.	DESCRIPTION
1	5SP-10	equip 10" Swing Nozzle
2	014250-45	Laminar Flow Device
3	013839-25	equip Swivel Nut
4	013848-45	equip Swivel Piece O-Ring
5	5-HDL-W	equip 4" Wrist Action Handle w/ Color Coded Screws
6	013788-45	equip Ceramic Cartridge, LTC
7	000999-45	Brass Lock Washer
8	002954-45	Shank Lock Nut
9	017587-45	Swivel Nut Seal
10	013787-45	equip Ceramic Cartridge, RTC



Model Number  
**5F-4CWX10**

Product Specifications:  
4" Deck Mount Workboard Mixing Faucet w/ Quarter-Turn Ceramic Cartridges, equip 4" Wrist Action Handles, equip 10" Swing Nozzle & 1/2" NPT Male Inlets

Product Compliance:  
ASME A112.18.1 / CSA B125.1  
NSF 61 - Section 9  
NSF 372 (Low Lead Content)  
ANSI A117.1 (ADA)

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## Submittal Sheet

01/09/2023

### ITEM# 68 - SHELVING, WALL MOUNTED (2 EA REQ'D)

Eagle Group WS1272-16/3

Shelf, wall-mounted, 72"W x 12"D, rolled frontedge, 1-1/2"H up-turn on sides & rear, includes stainless steel mounting brackets stud welded to shelf, 16/304 stainless steel construction, NSF

The spec sheet for this item can be viewed on item 15)

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	2		NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.



## Submittal Sheet

01/09/2023

### ITEM# 69 - PLANETARY MIXER (1 EA REQ'D)

Hobart HMM20-1STD

Centerline Planetary Mixer, 20 quart capacity, (3) fixed speeds, gear-driven transmission, digital controls, last time remind, stainless steel bowl, removable bowl guard, includes bayonet style wire whip, flat beater & dough hook, 1/2 HP motor, 100-120v/50/60/1-ph (Net)

#### ACCESSORIES

Mfr	Qty	Model	Spec
Hobart	1		Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA
Hobart	1	VS9-12	9" Vegetable Slicer for #12 attachment hub; includes back case, hopper front, & adjustable slicer plate, NSF
Hobart	1	VS9HOLD-SHG12	Plate Holder #12 hub, mounts shredder & grater plates
Hobart	1	VS9PLT-1/2SH	1/2" Shredder Plate
Hobart	1	VS9PLT-3/16SH	3/16" Shredder Plate

## ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	100-120	50/60	1						1/2		



## HMM20-1STD

### Mixer



### SPECIFIER STATEMENT

Specified unit will provide a minimum ½ HP high torque motor. The gear driven transmission will have hardened alloy steel, anti-friction ball bearings. 3-speed controls for maximum performance with agitator RMP speeds of 40,75,137. Digital controls with sealed push buttons and Last Time Remind. Stainless steel bowl, wire whip, flat beater and dough hook provided as well as removable bowl guard.

Project \_\_\_\_\_

AIA # \_\_\_\_\_ SIS # \_\_\_\_\_

Item # \_\_\_\_\_ Quantity \_\_\_\_\_ C.S.I. Section 114000

### MODEL

HMM20-1STD 20-quart mixer

### STANDARD FEATURES

- + Gear transmission
- + Three fixed speeds
- + Beater, whip and dough hook
- + Standard heavy-duty motor
- + ½ H.P. planetary output
- + GearSafe™ technology
- + Digital timer with Last Time Remind
- + Removable bowl guard
- + Large, easy-to-use controls
- + Stainless steel bowl guard
- + Metallic duo-tone styling
- + #12 taper attachment hub

### ACCESSORY PACKAGE

- HMM20-1STD Standard accessory package (includes):
  - 20-quart stainless steel bowl
  - 20-quart beater
  - 20-quart whip
  - 20-quart dough hook

HMM20-1STD MIXER

Approved by \_\_\_\_\_ Date \_\_\_\_\_ Approved by \_\_\_\_\_ Date \_\_\_\_\_



# HMM20-1STD Mixer

## SOLUTIONS/BENEFITS

### STANDARD HEAVY-DUTY PERFORMANCE

#### ½ HP High Torque Heavy Duty Motor

#### Gear Transmission

- + Reduced downtime

#### Three Fixed Speeds

- + For incorporating, blending, mixing ingredients
- + Provides the right speeds for consistent performance

### EASE OF USE

#### Digital Timer

- + Set minutes and seconds for accurate mixing performance
- + Eliminates overmixing

#### Last Time Remind

- + Remembers the last time set
- + Great for recipe batch use

#### Ergonomic Bowl lift with EZ Grip Handle

- + Designed with you in mind

#### Bayonet Style Agitators

- + Beater, whip and dough hook included

### SANITATION & CLEANING

#### Stainless Steel Bowl Guard

- + Removes for easy cleaning

### OPERATOR ASSURANCE

#### GearSafe™ Technology

- + Gear protection for accidental speed changes during operation

#### Triple Interlock System

- + Bowl-in-place
- + Bowl-up position
- + Bowl guard

## HMM20 MIXER CAPACITY CHART

Recommended Maximum Capacities – dough capacities based on 70°F. water and 12% flour moisture.

Product	Agitators Suitable for Operation	HMM20
CAPACITY OF BOWL (QUARTS LIQUID)		20
Egg Whites	whip	1 qt.
Mashed Potatoes	beater	15 lbs.
Mayonnaise (quarts of oil)	beater or dough	10 qts.
Meringue (quarts of water)	whip	1½ pts.
Waffle or Hot Cake Batter	beater	8 qts.
Whipped Cream	whip	4 qts.
Cake, Box or Slab	beater	20 lbs.
Cake, Cup	beater	20 lbs.
Cake, Layer	beater	20 lbs.□
Cake, Pound	beater	21 lbs.□
Cookies, Sugar	beater	15 lbs.
Dough, Bread or Roll (Light-Medium) 60% AR	§	dough 25 lbs.□
Dough Pie	beater	18 lbs.□
Dough, Thin Pizza (maximum mix time 5 minutes)	§‡	dough 9 lbs.□
Dough, Medium Pizza 50% AR	§‡	dough 10 lbs.□
Dough, Raised 65% AR		dough 9 lbs.*
Dough, Whole Wheat 70% AR		dough 20 lbs.
Eggs & Sugar for Sponge Cake	beater	8 lbs.
Shortening & Sugar, Creamed	beater	16 lbs.
Pasta, Basic Egg Noodle (maximum mix time 5 minutes)	dough	5 lbs.

NOTE: % AR (% Absorption Ratio) - Water weight divided by flour weight. Capacity depends on moisture content of dough.

□ 1st Speed

\* 2nd Speed

† 3rd Speed

§ If high gluten flour is used, reduce above dough batch size by 10%.

‡ 2nd Speed should never be used on 50% AR or lower products.

**USE OF ICE REQUIRES A 10% REDUCTION IN BATCH SIZE.**

**1 gallon of water weighs 8.33 lbs.**

NOTE: Attachment hub should not be used while mixing.



# HMM20-1STD

## Mixer

### SPECIFICATIONS

**Motor:** ½ HP high torque heavy duty motor  
100-120/50/60/1 9.0 Amps

**Electrical:** 100-120/50/60/1 – ETL Listed.

**Controls:** Solid state overload protection. Internally sealed “Start-Stop” push buttons. No Volt Release. Standard digital timer. **Last Time Remind**, recalls the time set from last batch operation.

**Transmission:** Gear-driven. Gears are constant mesh heat-treated hardened alloy steel along with anti-friction ball bearings. Grease lubricants furnished to all gears and shafts.

#### Speeds:

	Agitator (RPM)
First	40
Second	75
Third	137

**Bowl Guard:** Stainless steel wire front and solid rear portion. Front portion of guard rotates easily to add ingredients and install or remove agitator. It detaches in seconds for cleaning in dishwasher or sink. Rear portion of guard can be quickly cleaned in position. Guard must be in closed position before mixer will operate.

**Bowl Lift:** Ergonomic style, hand crank operated, easy to operate.

**Finish:** Metallic duo-tone gray & black.

**Attachment Hub:** Comes with front-mounted Hobart standard #12 taper attachment hub for use with Hobart #12 size attachments.

#### Attachments & Accessories (Available at extra cost):

- BOWL-HMM20 – Stainless steel bowl
- BEATER-HMM20 – Flat beater
- WHIP-HMM20 – Wire whip
- DOUGH-HMM20 – Dough hook
- JDOUGH-HMM20 – “J” Dough hook
- CHUTE-HMM20 – Ingredient chute
- VS9 Vegetable slicer
- Meat chopper attachment

**centerline**  
by **HOBART**

**HMM20-1STD**  
Mixer

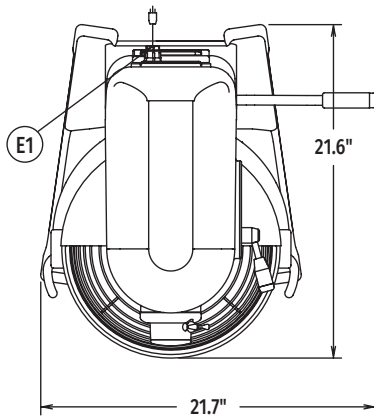
## SPECIFICATIONS

**Electrical Specifications:** 100-120/50/60/1, ETL listed

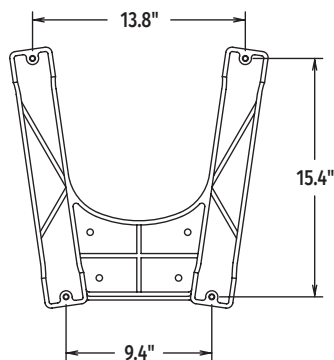
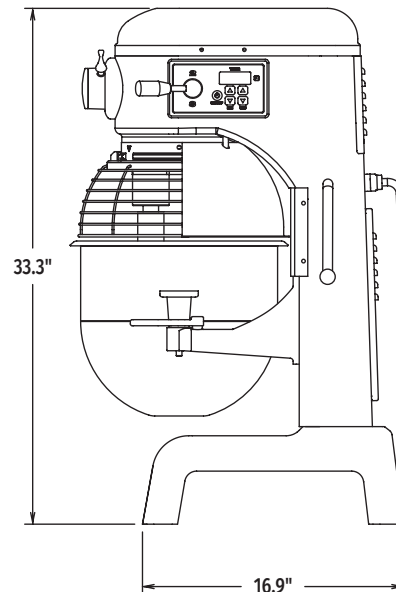
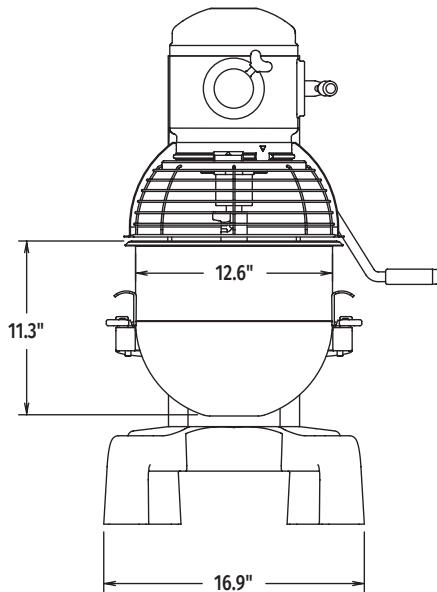
**Weight:** 189 lbs. net; 204 lbs. domestic shipping.

**Warranty:** Unit has full one-year warranty on parts, labor and mileage against manufacturer's defects. Service contracts are available

## DETAILS AND DIMENSIONS



**WARNING:** Must comply with the applicable portions of the National Electrical Code and/or other local electrical codes.



**MACHINE ELECTRICAL SPECS:**  
100-120/50/60/1 – ETL Listed

As continued product improvement is a policy of Hobart, specifications are subject to change without notice.

CAD and/or Revit Files Available



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1-888-4HOBART • www.hobartcorp.com

## VS9 VEGETABLE SLICER, MEAT CHOPPER ATTACHMENT AND MIXER ACCESSORIES



VS9 VEGETABLE SLICER, MEAT CHOPPER ATTACHMENT AND MIXER ACCESSORIES

### 9" VEGETABLE SLICER

One of the most useful Hobart Attachments is the VS9 Vegetable Slicer.

It will more than double the utility of a Hobart Mixer or Food Cutter. Its uses are many and varied: cutting cabbage for salads and cole slaw, slicing potatoes ranging in thickness from that of a potato chip to 5/8". Slicing nuts, bananas, cucumbers, celery and other vegetables and fruits, shredding or grating cheese, raw carrots, beets, etc.

The food is sliced by stainless steel scimitar knives for fast clean, uniform cutting. The front of the Vegetable Slicer is hinged at one side, and can be swung aside or removed, permitting quick and easy changing of plates and cleaning.

The Vegetable Slicer Attachment includes back case, hopper front and adjustable slice plate. Shredder and grater plates (interchangeable with slice plate).

The 9" Vegetable Slicer may also be used with the PD-35 or PD-70 Power Drive units.  
PD35 – For use with cheese and vegetables.  
PD70 – For use with vegetables only



9" VEGETABLE SLICER

### SHREDDER AND GRATER PLATES FOR 9" VEGETABLE SLICER



Adjustable Slice Plate - 5/8" to very thin.



Plate Holder Assembly



Grater Plate



3/32" Shredder Plate



5/16" Shredder Plate



3/16" Shredder Plate



1/2" Shredder Plate



### MEAT AND FOOD CHOPPER

Turn meat and food trimmings into croquettes, meat patties or sausage with the use of this attachment. No kitchen should be without this important piece of equipment.

Hobart-designed, protective type spiral fluted chopping-end worm provides clean cutting action. There is no crushing or mashing of product; its natural color and flavor are retained.





# VS9 VEGETABLE SLICER, MEAT CHOPPER ATTACHMENT AND MIXER ACCESSORIES

## HOBART

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### ADDITIONAL ACCESSORIES FOR HOBART MIXERS

A wide selection of practical attachments and accessories for Mixers further increase their broad range of usefulness. These attachments meet specific needs and are constructed to operate with continued reliability.

#### BOWL SPLASH COVER



This is used to control splash of light ingredients during mixing operations.

#### BOWL EXTENSION RING



Provides higher sidewalls for the bowl to prevent throw-out of certain ingredients. Does not increase bowl capacity.

#### BOWL TRUCK ADAPTER



For use with 30 and 40-quart bowl sizes of floor model mixers. Inserts easily into the standard bowl truck.

#### BOWL TRUCK

Self-centering, with four rubber-tired wheels and guide handle for easy portability when moving large bowls for floor model mixers.

#### BOWL SCRAPER









The scraper is used in conjunction with the B Beater or Wire Whips. While the agitator is mixing the product, the scraper is continuously scraping the inside of the mixer bowl. No more stopping mid-cycle to manually scrape down the sides of the bowl. The bowl scrapers are built to last and are made of urethane elastomer. The optional bowl scraper is available for the following models: HL120, HL200, D300, D340, HL600, HL800 and HL1400.

**NOTE:** Bowl scrapers should be used with Stainless Steel Bowls only.

As continued product improvement is a policy of Hobart, specifications are subject to change without notice.

**HOBART**701 S Ridge Avenue, Troy, OH 45374  
1-888-4HOBART • www.hobartcorp.com**HOBART LEGACY® MIXER  
AGITATORS AND ATTACHMENTS****HOBART****HOBART LEGACY® MIXER AGITATORS AND ATTACHMENTS****HOBART LEGACY® MIXER AGITATOR/APPLICATION**






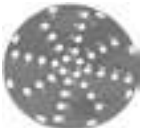

ATTACHMENT	APPLICATION	FOOD PRODUCTS	RECOMMENDATIONS
<b>"B" FLAT BEATER</b> 	<ul style="list-style-type: none"> <li>Multi-purpose agitator</li> </ul>	<ul style="list-style-type: none"> <li>Mashing potatoes</li> <li>Mixing cakes</li> <li>Icings</li> </ul>	<ul style="list-style-type: none"> <li>Use 1st speed for starting</li> <li>Medium speed for finishing</li> </ul>
<b>"D" WIRE WHIP</b> 	<ul style="list-style-type: none"> <li>Maximum blending of air into light products</li> </ul>	<ul style="list-style-type: none"> <li>Whipping cream</li> <li>Beating egg whites</li> </ul>	<ul style="list-style-type: none"> <li>3rd or 4th speed</li> </ul>
<b>"ED" DOUGH ARM</b> 	<ul style="list-style-type: none"> <li>Mixing</li> <li>Folding</li> <li>Stretching dough</li> </ul>	<ul style="list-style-type: none"> <li>Breads</li> <li>Pizza dough</li> </ul>	<ul style="list-style-type: none"> <li>1st or 2nd speed for 2 and 3 speed mixers</li> <li>1st, 2nd or 3rd speed for 4 speed mixers</li> </ul>
<b>"C" WING WHIP</b> 	<ul style="list-style-type: none"> <li>Heavy whipping</li> </ul>	<ul style="list-style-type: none"> <li>Potatoes</li> <li>Butter</li> <li>Mayonnaise</li> <li>Light icing</li> </ul>	<ul style="list-style-type: none"> <li>1st or 2nd speed</li> </ul>
<b>"I" HEAVY DUTY WIRE WHIP</b> 	<ul style="list-style-type: none"> <li>Heavy whipping</li> </ul>	<ul style="list-style-type: none"> <li>Sponge cakes</li> <li>Light marshmallow</li> </ul>	<ul style="list-style-type: none"> <li>3rd or 4th speed</li> </ul>
<b>"P" PASTRY KNIFE</b> 	<ul style="list-style-type: none"> <li>Cutting action for combining ingredients</li> </ul>	<ul style="list-style-type: none"> <li>Pastry dough</li> <li>Pie dough</li> </ul>	<ul style="list-style-type: none"> <li>For stirring use low speeds</li> <li>For cutting use medium speeds</li> </ul>

# HOBART LEGACY® MIXER AGITATORS AND ATTACHMENTS

**HOBART**

 701 S Ridge Avenue, Troy, OH 45374  
 1-888-4HOBART • www.hobartcorp.com

## HOBART LEGACY® MIXER ATTACHMENTS

ATTACHMENT	APPLICATION	FOOD PRODUCTS	RECOMMENDATIONS
<b>VS9 VEGETABLE SLICER</b> 	<ul style="list-style-type: none"> <li>Hub attachment for food processing. Adjustable slicer plate is standard with the VS9-12</li> </ul>	<ul style="list-style-type: none"> <li>Vegetables &amp; cheeses</li> </ul>	<ul style="list-style-type: none"> <li>Adjustable settings for approximately 5/8" to wafer thin</li> </ul>
<b>VS9 GRATER PLATE</b> 	<ul style="list-style-type: none"> <li>Grating</li> </ul>	<ul style="list-style-type: none"> <li>Natural hard cheeses</li> <li>Hard vegetables</li> <li>Spices</li> <li>Bread crumbs</li> </ul>	<ul style="list-style-type: none"> <li>1st or 2nd speed for 3 speed mixers</li> <li>1st, 2nd or 3rd speed for 4 speed mixers</li> </ul>
<b>VS9 3/32 SHREDDER PLATE</b> 	<ul style="list-style-type: none"> <li>Fine shredding</li> </ul>	<ul style="list-style-type: none"> <li>Cheeses</li> <li>Quick cooking vegetables</li> </ul>	<ul style="list-style-type: none"> <li>1st or 2nd speed for 3 speed mixers</li> <li>1st, 2nd or 3rd speed for 4 speed mixers</li> </ul>
<b>VS9 3/16 SHREDDER PLATE</b> 	<ul style="list-style-type: none"> <li>Medium shredding</li> </ul>	<ul style="list-style-type: none"> <li>Cheeses</li> <li>Salad vegetables</li> <li>Quick cooking vegetables</li> </ul>	<ul style="list-style-type: none"> <li>1st or 2nd speed for 3 speed mixers</li> <li>1st, 2nd or 3rd speed for 4 speed mixers</li> </ul>
<b>VS9 5/16 SHREDDER PLATE</b> 	<ul style="list-style-type: none"> <li>Medium shredding</li> </ul>	<ul style="list-style-type: none"> <li>Cheeses</li> <li>Salad vegetables</li> <li>Quick cooking vegetables</li> </ul>	<ul style="list-style-type: none"> <li>1st or 2nd speed for 3 speed mixers</li> <li>1st, 2nd or 3rd speed for 4 speed mixers</li> </ul>
<b>VS9 1/2 SHREDDER PLATE</b> 	<ul style="list-style-type: none"> <li>Course shredding</li> </ul>	<ul style="list-style-type: none"> <li>Cole slaw</li> <li>Soup stock</li> <li>Hash browns</li> </ul>	<ul style="list-style-type: none"> <li>1st or 2nd speed for 3 speed mixers</li> <li>1st, 2nd or 3rd speed for 4 speed mixers</li> </ul>
<b>MEAT CHOPPER ATTACHMENT</b> 	<ul style="list-style-type: none"> <li>Chops and combines ingredients with meat products</li> </ul>	<ul style="list-style-type: none"> <li>Sausage mixing</li> <li>Sandwich spreads</li> <li>Cheese spreads</li> </ul>	<ul style="list-style-type: none"> <li>3rd speed for 3 speed mixers</li> <li>2nd speed for 4 speed mixers</li> </ul>

As continued product improvement is a policy of Hobart, specifications are subject to change without notice.



## Submittal Sheet

01/09/2023

### ITEM# 70 - EQUIPMENT STAND, FOR MIXER / SLICER (1 EA REQ'D)

Eagle Group MS2424S

Mixer Stand, stationary, 24"W x 24"D x 24"H, 16/300 series stainless steel top with 600 lbs. capacity, rolled front edge, stainless steel adjustable undershelf with 150 lbs. capacity, Uni-Lok® gusset system, stainless steel legs with adjustable stainless steel bullet feet, NSF

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	1		NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.
Eagle Group	1	CA4-SB	Table Casters, set of (4), 4" diameter, (2) swivel & (2) swivel/brake, 115 lbs. capacity per caster, zinc with resilient tread, NSF



Profit from the Eagle Advantage®

## Specification Sheet

### Short Form Specifications

Eagle Mixer Stand, model \_\_\_\_\_ . Top to be 16 gauge 300 series stainless steel with rolled edges on all sides. 24" O.A. working height. Constructed with uni-lok® patented gusset system, with the gussets recessed into the hat channels to reduce lateral movement.

- *Units with undershelf:* Heavy gauge galvanized or stainless steel adjustable undershelf. 1½" O.D. galvanized or stainless steel tubular legs with adjustable bullet feet.
- *Units with tubular base:* 1½" O.D. galvanized or stainless steel adjustable tubular legs with 1¼" O.D. galvanized or stainless steel tubular cross rails, and adjustable bullet feet.

Eagle Utensil Rack, model UR-501, for mixer stands. 1½"-diameter stainless steel rod with five ⅝" stainless steel rods, approximately 5" long, for utensils.



mixer stand shown with optional utensil rack

### Options / Accessories

- Drawers
- Casters
- Utensil rack

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Phone: 302-653-3000 • Fax: 302-653-2065 • e-mail: quotes@eaglegrp.com

Item No.: \_\_\_\_\_  
Project No.: \_\_\_\_\_  
S.I.S. No.: \_\_\_\_\_

## Mixer Stands

### MODELS:

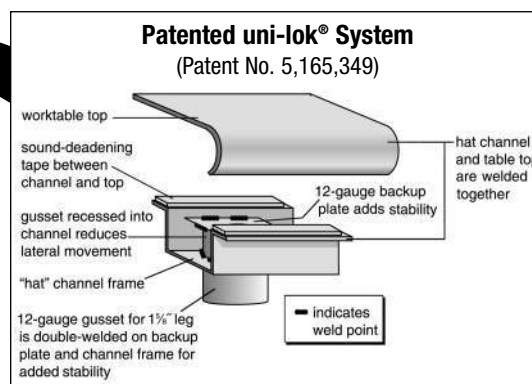
- |                                  |                                   |                                   |                                   |
|----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| <input type="checkbox"/> MS2424  | <input type="checkbox"/> MS3036   | <input type="checkbox"/> TMS3024  | <input type="checkbox"/> TMS3636  |
| <input type="checkbox"/> MS2424S | <input type="checkbox"/> MS3036S  | <input type="checkbox"/> TMS3024S | <input type="checkbox"/> TMS3636S |
| <input type="checkbox"/> MS3024  | <input type="checkbox"/> MS3636   | <input type="checkbox"/> TMS3030  | <input type="checkbox"/> CA4-SB   |
| <input type="checkbox"/> MS3024S | <input type="checkbox"/> MS3636S  | <input type="checkbox"/> TMS3030S | <input type="checkbox"/> CA6-SB   |
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| <input type="checkbox"/> MS3030S | <input type="checkbox"/> TMS2424S | <input type="checkbox"/> TMS3036S | <input type="checkbox"/> CAH6-SB  |
|                                  |                                   |                                   | <input type="checkbox"/> UR-501   |

### Mixer Stands

- Highly-polished die-formed 16 gauge 300 series stainless steel tabletop, with rolled front edge and ends turned down at 90°.
- Uni-lok® gusset system (patent #5,165,349): gusset is recessed into hat channel underside tabletop, reducing lateral movement.
- Galvanized or stainless steel base available with adjustable undershelf or adjustable tubular frame.
- 1½" (41mm)-diameter legs are galvanized with adjustable non-marking plastic bullet feet, or stainless steel with stainless steel adjustable bullet feet.
- Tabletop weight capacity: 600 lbs. (272.2 kg).
- Undershelf weight capacity: 150 lbs. (68.0 kg).

### Optional Utensil Rack—#UR-501

- Five ⅝" (8mm)-diameter stainless steel utility rods approximately 5" (127mm) in length.
- 1½" (41mm)-diameter stainless steel tubular support, 54" (1371mm) height.



### Certifications / Approvals



### AUTOQUOTES



EG10.26A Rev. 09/21

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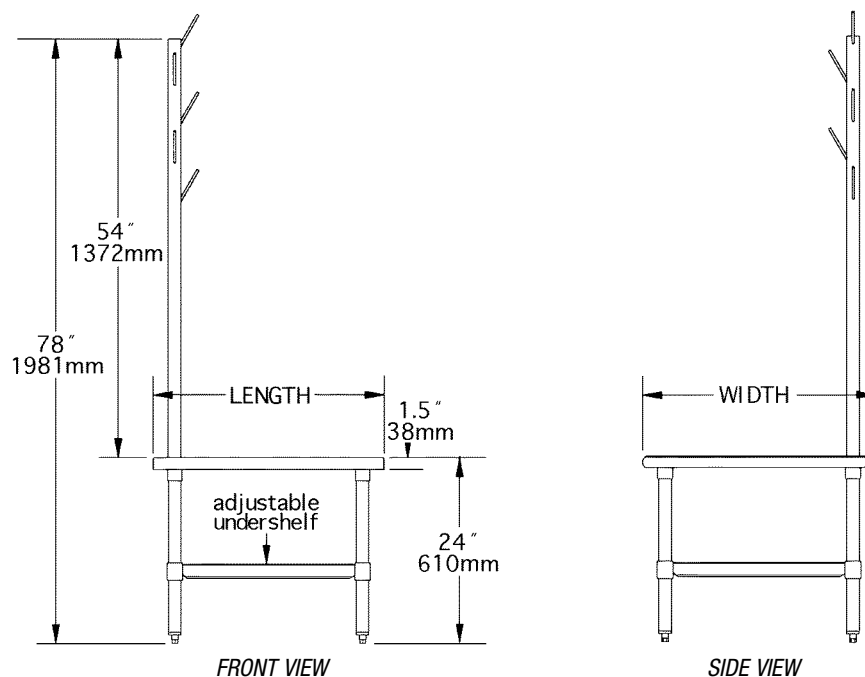
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Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

## Mixer Stands



(mixer stand with optional utensil rack)

width			length		weight lbs. kg	...WITH UNDERSHELF		...WITH TUBULAR BASE	
in.	mm	in.	mm	with galvanized legs model #		with stainless steel legs model #	with galvanized legs model #	with stainless steel legs model #	
24"	610	24"	610	42	19.1	<b>MS2424</b>	<b>MS2424S</b>	<b>TMS2424</b>	<b>TMS2424S</b>
30"	762	24"	610	47	21.3	<b>MS3024</b>	<b>MS3024S</b>	<b>TMS3024</b>	<b>TMS3024S</b>
30"	762	30"	762	49	22.2	<b>MS3030</b>	<b>MS3030S</b>	<b>TMS3030</b>	<b>TMS3030S</b>
30"	762	36"	914	51	23.1	<b>MS3036</b>	<b>MS3036S</b>	<b>TMS3036</b>	<b>TMS3036S</b>
36"	914	36"	914	53	24.0	<b>MS3636</b>	<b>MS3636S</b>	<b>TMS3636</b>	<b>TMS3636S</b>



### Optional Casters

description	weight cap. per caster		model #
	lbs.	kg	
4" (102mm)-dia., set of four (two swivel, two w/brake)	115	52.2	<b>CA4-SB</b>
4" (102mm)-dia., set of six (three swivel, three w/brake)	115	52.2	<b>CA6-SB</b>
5" (127mm)-dia., set of four (two swivel, two w/brake)	200	90.7	<b>CAH4-SB</b>
5" (127mm)-dia., set of six (three swivel, three w/brake)	200	90.7	<b>CAH6-SB</b>

### Optional Utensil Rack

weight		model #
lbs.	kg	
23	10.4	<b>UR-501</b>

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Rev. 09/21

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## Specification Sheet

Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

### Table Accessories

#### MODELS:

- 24\*GADJUS       CA\*-SB  
 24\*SADJUS\*       PS\*  
 30\*GADJUS       SB-1  
 30\*SADJUS\*       W TSA30

\* See charts for complete model numbers.

#### Spice Bin

- Designed for either overshelf or wall shelf applications.
- 22 gauge stainless steel with fully covered deep-drawn construction.
- Complete with label holders.

model #	width		length		height*		weight	
	in.	mm	in.	mm	in.	mm	lbs.	kg
SB-1	6½"	165	5½"	140	6"	156	1.5	0.7

\* Must allow 7¾" (197mm) space. Bin slides on stainless steel angle supports secured to underside of shelf.

#### Power Strips for Stainless Steel Tables with Backsplash

- Mounts onto backsplash via two stainless steel clips—no tools required.
- Brushed aluminum finish.
- 15' (4572mm)-long cord and plug.
- ON-OFF toggle switch and reset button.

model #	length		number of outlets
	in.	mm	
PS2408	24"	610	8
PS3612	36"	914	12
PS4816	48"	1219	16
PS6020	60"	1524	20

#### Stabilizer Bars (pair)\*\*

- Fits standard 30" and 36" (762 and 914mm)-wide worktables.
- Positioned at an angle to add maximum stability to table.
- 12 gauge Valu-Master® epoxy coated gussets welded onto ends of each 12 gauge galvanized angle bar.
- Stands 19½" (495mm) when mounted to table.

model # (pair): **W TSA30**

\*\* Stabilizer Bars and Extra Undershelves will not work together.



#### Casters — chart on back page

- Offered in sets of four, six, and eight casters.
- Available in zinc with resilient or poly tread, or polymer cart washable with polymer tread.

#### Extra Undershelves\*\* — chart on back page

- For tables with uni-lok® hat channel frame.
- Designed for storage of shorter, smaller items under worktable where only one undershelf might not suffice.
- Adjustable, available in galvanized or stainless steel.

#### EAGLE GROUP

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For custom configuration or fabrication needs, contact our **SpecFAB®** Division.

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## AUTOQUOTES



EG10.59 Rev. 05/11

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Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

## Table Accessories

### Casters

set of	caster diameter		ZINC WITH RESILIENT TREAD			ZINC WITH POLY TREAD			POLY CART WASHABLE WITH POLY TREAD		
	in.	mm	model #	wt. cap. per caster		model #	wt. cap. per caster		model #	wt. cap. per caster	
				lbs.	kg		lbs.	kg		lbs.	kg
4 swivel (2 with brake)	4"	102	CA4-SB	115	52.2	n/a			n/a		
6 swivel (3 with brake)	4"	102	CA6-SB	115	52.2	n/a			n/a		
8 swivel (4 with brake)	4"	102	CA8-SB	115	52.2	n/a			n/a		
4 swivel (2 with brake)	5"	127	CAH4-SB	200	90.7	CAHP4-SB	250	113.4	CAHW4-SB	250	113.4
6 swivel (3 with brake)	5"	127	CAH6-SB	200	90.7	CAHP6-SB	250	113.4	CAHW6-SB	250	113.4
8 swivel (4 with brake)	5"	127	CAH8-SB	200	90.7	CAHP8-SB	250	113.4	CAHW8-SB	250	113.4

### Extra Undershelves

Note: When ordering an extra or replacement undershelf, please order per the size of your tabletop. Please note the "for table size" column in chart below.

GALVANIZED model #	STAINLESS STEEL		for table size *				weight	
	model #	model #	width		length		lbs.	kg
			in.	mm	in.	mm		
2424GADJUS	2424SADJUS-18/4	2424SADJUS-18/3	24"	610	24"	610	15	6.6
2430GADJUS	2430SADJUS-18/4	2430SADJUS-18/3	24"	610	30"	762	18	8.2
2436GADJUS	2436SADJUS-18/4	2436SADJUS-18/3	24"	610	36"	914	21	9.6
2448GADJUS	2448SADJUS-18/4	2448SADJUS-18/3	24"	610	48"	1219	27	12.2
2460GADJUS	2460SADJUS-18/4	2460SADJUS-18/3	24"	610	60"	1524	33	15.0
2472GADJUS	2472SADJUS-18/4	2472SADJUS-18/3	24"	610	72"	1829	39	17.6
2484GADJUS	2484SADJUS-18/4	2484SADJUS-18/3	24"	610	84"	2134	45	20.4
2496GADJUS	2496SADJUS-18/4	2496SADJUS-18/3	24"	610	96"	2438	51	23.1
24108GADJUS	24108SADJUS-18/4	24108SADJUS-18/3	24"	610	108"	2743	57	25.9
24120GADJUS	24120SADJUS-18/4	24120SADJUS-18/3	24"	610	120"	3048	63	28.6
24132GADJUS	24132SADJUS-18/4	24132SADJUS-18/3	24"	610	132"	3353	69	31.3
24144GADJUS	24144SADJUS-18/4	24144SADJUS-18/3	24"	610	144"	3658	75	34.0
3024GADJUS	3024SADJUS-18/4	3024SADJUS-18/3	30"	762	24"	610	17	7.5
3030GADJUS	3030SADJUS-18/4	3030SADJUS-18/3	30"	762	30"	762	21	9.5
3036GADJUS	3036SADJUS-18/4	3036SADJUS-18/3	30"	762	36"	914	24	10.7
3048GADJUS	3048SADJUS-18/4	3048SADJUS-18/3	30"	762	48"	1219	30	13.6
3060GADJUS	3060SADJUS-18/4	3060SADJUS-18/3	30"	762	60"	1524	36	16.3
3072GADJUS	3072SADJUS-18/4	3072SADJUS-18/3	30"	762	72"	1829	42	19.1
3084GADJUS	3084SADJUS-18/4	3084SADJUS-18/3	30"	762	84"	2134	48	21.8
3096GADJUS	3096SADJUS-18/4	3096SADJUS-18/3	30"	762	96"	2438	54	24.5
30108GADJUS	30108SADJUS-18/4	30108SADJUS-18/3	30"	762	108"	2743	60	27.2
30120GADJUS	30120SADJUS-18/4	30120SADJUS-18/3	30"	762	120"	3048	66	29.9
30132GADJUS	30132SADJUS-18/4	30132SADJUS-18/3	30"	762	132"	3353	72	32.7
30144GADJUS	30144SADJUS-18/4	30144SADJUS-18/3	30"	762	144"	3658	78	35.4

\* Undershelves for 30" (762mm)-wide tables listed above also fit 36" (915mm)-wide tables.

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## Submittal Sheet

01/09/2023

### ITEM# 71 - WORK TABLE, STAINLESS STEEL TOP (1 EA REQ'D)

Eagle Group T3060STE-BS

Spec-Master® Series Work Table, 60"W x 30"D, 4-1/2"H backsplash, 14/300 series stainless steel top, rolled front edge, Uni-Lok® gusset system, stainless steel crossrails on side & rear, (4) stainless steel legs & adjustable bullet feet, NSF

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	1	E101A	Turn down back of splash per table with Z clip

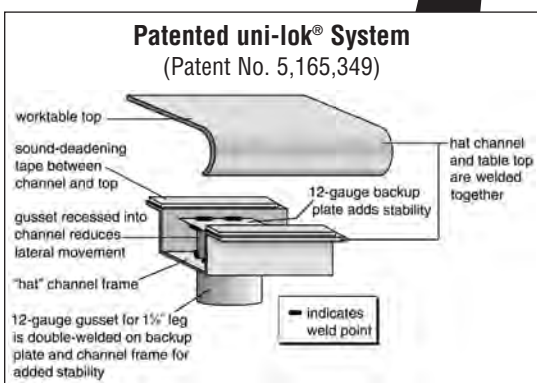


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## Specification Sheet

### Short Form Specifications

Eagle worktables, Spec-Master® series, model \_\_\_\_\_ . Top constructed of 14 gauge 300 series stainless steel with 1½" roll on front, 4½" backplash, and sides turned down 90°. Open front with 1¼" O.D., stainless steel tubular cross bracing on sides and rear. Top reinforced with welded hat channels and sound deadened. Constructed with uni-lok® patented gusset system with the gussets recessed into the hat channels to reduce lateral movement. Legs are 1½" O.D., stainless steel tubing, with stainless steel gussets and 1" adjustable stainless steel bullet feet.



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Item No.: \_\_\_\_\_

Project No.: \_\_\_\_\_

S.I.S. No.: \_\_\_\_\_

## Worktables with Backsplash and Stainless Steel Tubular Base —Spec-Master® Series

### MODELS:

- |                                      |                                       |                                       |                                       |
|--------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| <input type="checkbox"/> T2424STE-BS | <input type="checkbox"/> T24108STE-BS | <input type="checkbox"/> T3072STE-BS  | <input type="checkbox"/> T3660STE-BS  |
| <input type="checkbox"/> T2430STE-BS | <input type="checkbox"/> T24120STE-BS | <input type="checkbox"/> T3084STE-BS  | <input type="checkbox"/> T3672STE-BS  |
| <input type="checkbox"/> T2436STE-BS | <input type="checkbox"/> T24132STE-BS | <input type="checkbox"/> T3096STE-BS  | <input type="checkbox"/> T3684STE-BS  |
| <input type="checkbox"/> T2448STE-BS | <input type="checkbox"/> T24144STE-BS | <input type="checkbox"/> T30108STE-BS | <input type="checkbox"/> T3696STE-BS  |
| <input type="checkbox"/> T2460STE-BS | <input type="checkbox"/> T3030STE-BS  | <input type="checkbox"/> T30120STE-BS | <input type="checkbox"/> T36108STE-BS |
| <input type="checkbox"/> T2472STE-BS | <input type="checkbox"/> T3036STE-BS  | <input type="checkbox"/> T30132STE-BS | <input type="checkbox"/> T36120STE-BS |
| <input type="checkbox"/> T2484STE-BS | <input type="checkbox"/> T3048STE-BS  | <input type="checkbox"/> T30144STE-BS | <input type="checkbox"/> T36132STE-BS |
| <input type="checkbox"/> T2496STE-BS | <input type="checkbox"/> T3060STE-BS  | <input type="checkbox"/> T3648STE-BS  | <input type="checkbox"/> T36144STE-BS |

### Tabletop

- Patented uni-lok® gusset system (patent #5,165,349): gussets are recessed into hat channel, reducing lateral movement.
- Top reinforced with welded-on hat channel.
- Sound-deadened between top and channels.
- 4½" (114mm)-high 90° backplash with 1" (25mm) turn at 90°.
- 1½" (38mm)-diameter 180° rolled edge on front. Ends are turned down 90°, providing for flush installations when required.
- 14 gauge 300 series polished stainless steel.

### Crossbracing—1¼" (38mm)-diameter

- Heavy gauge stainless steel.
- Aluminum castings join crossbraces, legs and rear brace.

### Legs—1½" (41mm)-diameter

- Tables 96" (2438mm) and longer come with six legs or more.
- Heavy gauge stainless steel.
- 1" (25mm) adjustable stainless steel feet.

### Options / Accessories

- |  |  |
|--|--|
| <input type="checkbox"/> Drawer                              | <input type="checkbox"/> Duplex receptacles                            |
| <input type="checkbox"/> Lock                                | <input type="checkbox"/> Pot rack                                      |
| <input type="checkbox"/> Casters                             | <input type="checkbox"/> Sink  |
| <input type="checkbox"/> Stainless steel bullet feet         | <input type="checkbox"/> Stabilizer Bar (for 30"- and 36"-wide tables) |
| <input type="checkbox"/> Overshelves                         |  |
| <input type="checkbox"/> Power strip (for material handling) |  |

### Certifications / Approvals



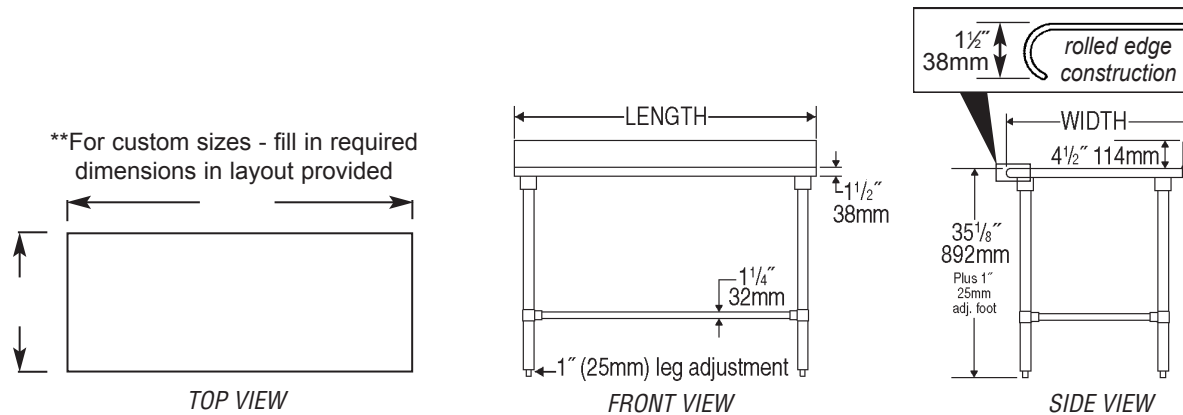
### AUTOQUOTES





Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

## Worktables with Backsplash and Stainless Steel Tubular Base —Spec-Master® Series



model #	# of legs	width		length		weight	
		in.	mm	in.	mm	lbs.	kg
T2424STE-BS	4	24"	610	24"	610	45	20.4
T2430STE-BS	4	24"	610	30"	762	51	23.1
T2436STE-BS	4	24"	610	36"	914	56	25.4
T2448STE-BS	4	24"	610	48"	1219	67	30.4
T2460STE-BS	4	24"	610	60"	1524	78	35.4
T2472STE-BS	4	24"	610	72"	1829	89	40.4
T2484STE-BS	4	24"	610	84"	2134	100	45.4
T2496STE-BS	6	24"	610	96"	2438	111	50.3
T24108STE-BS	6	24"	610	108"	2743	122	55.8
T24120STE-BS	6	24"	610	120"	3048	133	60.3
T24132STE-BS	8	24"	610	132"	3353	144	65.3
T24144STE-BS	8	24"	610	144"	3658	155	70.3
T3030STE-BS	4	30"	762	30"	762	56	25.4
T3036STE-BS	4	30"	762	36"	914	62	28.1
T3048STE-BS	4	30"	762	48"	1219	73	33.1
T3060STE-BS	4	30"	762	60"	1524	84	38.1
T3072STE-BS	4	30"	762	72"	1829	95	43.1
T3084STE-BS	4	30"	762	84"	2134	106	48.1
T3096STE-BS	6	30"	762	96"	2438	117	53.1
T30108STE-BS	6	30"	762	108"	2743	128	58.1
T30120STE-BS	6	30"	762	120"	3048	139	63.1
T30132STE-BS	8	30"	762	132"	3353	150	68.0
T30144STE-BS	8	30"	762	144"	3658	161	73.0
T3648STE-BS	4	36"	914	48"	1219	78	35.4
T3660STE-BS	4	36"	914	60"	1524	89	40.4
T3672STE-BS	4	36"	914	72"	1829	100	45.4
T3684STE-BS	4	36"	914	84"	2134	111	50.3
T3696STE-BS	6	36"	914	96"	2438	122	55.3
T36108STE-BS	6	36"	914	108"	2743	133	60.3
T36120STE-BS	6	36"	914	120"	3048	144	65.3
T36132STE-BS	8	36"	914	132"	3353	155	70.3
T36144STE-BS	8	36"	914	144"	3658	166	75.3

### EAGLE GROUP

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Foodservice Division: Phone 800-441-8440

MHC/Retail Display Divisions: Phone 800-637-5100

Spec sheets available for viewing, printing or downloading from our online literature library at [www.eaglegrp.com](http://www.eaglegrp.com)

Although every attempt has been made to ensure the accuracy of the information provided, we cannot be held responsible for typographical or printing errors. Information and specifications are subject to change without notice. Please confirm at time of order.



## Submittal Sheet

01/09/2023

### ITEM# 72 - SHELVING, WALL MOUNTED (1 EA REQ'D)

Eagle Group WS1260-16/3

Shelf, wall-mounted, 60"W x 12"D, rolled frontedge, 1-1/2"H up-turn on sides & rear, includes stainless steel mounting brackets stud welded to shelf, 16/304 stainless steel construction, NSF

The spec sheet for this item can be viewed on item 15)

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	1		NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.



## Submittal Sheet

01/09/2023

### ITEM# 73 - INGREDIENT BIN (1 EA REQ'D)

Cambro

#### ACCESSORIES

Mfr	Qty	Model	Spec
Cambro	1	IB44148	Ingredient Bin, mobile, 42-1/2 gallon capacity, molded polyethylene with sliding cover, (4) 3" heavy duty casters (2 front swivel, 2 fixed), with bin securely attached to base plate, white with clear cover, NSF
Cambro	1	IBS20148	Ingredient Bin, mobile, 21 gallon capacity, molded polyethylene with sliding cover, S-hook on front (scoop NOT included), (4) 3" heavy duty casters (2 front swivel, 2 fixed), with bin securely attached to base plate, white with clear cover, NSF
Cambro	1	IBS27148	Ingredient Bin, mobile, 27 gallon capacity, 1-pc seamless polyethylene bin, 2-pc sliding polycarbonate lid, S-hook on front (scoop NOT included), (4) 3" heavy duty casters (2 front swivel, 2 fixed), white with clear cover, NSF

**CAMBRO****Ingredient Bins****Standard**

- Models IBSF27 – 27 gallon (102 L)  
 IB32 – 32 gallon (121 L)  
 IB36 – 34 gallon (129 L)  
 IB44 – 43 gallon (161 L)

Item No. \_\_\_\_\_

Specifier Identification No. \_\_\_\_\_

Model No. \_\_\_\_\_

Quantity \_\_\_\_\_

**Features & Benefits**

- Stores and transports a wide variety of dry ingredients such as flour, sugar, rice or grains. Perfect for restaurants, food manufacturers or commissaries.
- Available in 27, 32, 34, and 43 gallon (102, 121, 129, 161 L) capacity to meet standard industry requirements for storage and transportation of bulk foods.
- One-piece, seamless single-wall polyethylene bin construction is extremely durable. Won't rust or corrode. Liquids and dry foods will not stick or seep between seams.
- FDA accepted material. Meets all food contact requirements and eliminates need for liners.
- Smooth interior and exterior are easy to clean.
- Injection molded Camwear® polycarbonate lids are transparent, break resistant and offer quick and easy identification of contents. Slide-back feature for easy access.
- Working height permits storage under standard work tables.
- Heavy-duty 3" (7,6 cm) casters, 2 front swivel, 2 fixed, are bolted into molded-in steel plates and will not pull out or fall off.
- No assembly required.
- Available in White (148) only with Clear (135) cover.



IBSF27



IB32



IB36



IB44

**Approvals****CAMBRO**

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 Telephone 714 848 1555 Toll Free 800 854 7631 Customer Service Department 800 833 3003

# Ingredient Bins

## Standard

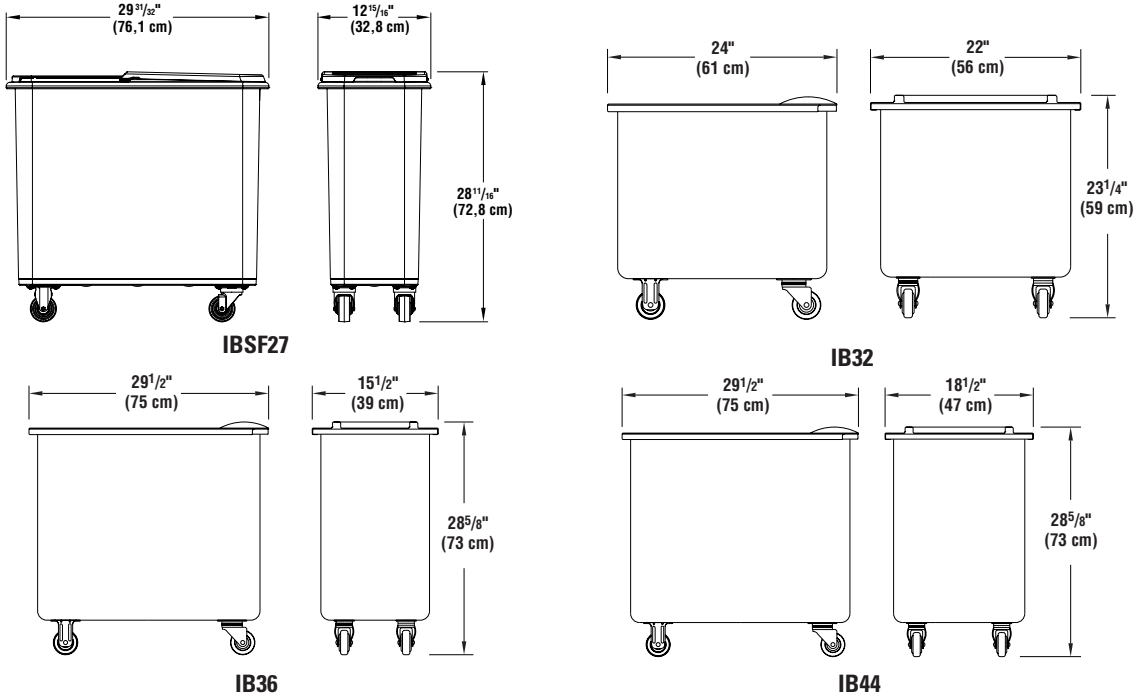
- Models IBSF27 – 27 gallon (102 L)
- IB32 – 32 gallon (121 L)
- IB36 – 34 gallon (129 L)
- IB44 – 43 gallon (161 L)

**Item No.** \_\_\_\_\_

**Specifier Identification No.** \_\_\_\_\_

**Model No.** \_\_\_\_\_

**Quantity** \_\_\_\_\_



## Specifications

Dimension Tolerance: +/- 1/4" (0,64 cm)

Code	Description	Volume Capacity	Load Capacity		Exterior Dimensions W x D x H	Case lbs./cube Kg/m <sup>3</sup>
			Sugar	Flour		
IBSF27	27 gal. Ingredient Bin (102 L)	3.56 Cubic feet (0,100) Cubic meters	216 lbs. (98 kg.)	150 lbs. (68 kg.)	12 <sup>15</sup> / <sub>16</sub> " x 29 <sup>31</sup> / <sub>32</sub> " x 28 <sup>11</sup> / <sub>16</sub> " (32,8 x 76,1 x 72,8 cm)	28.5 (6.91)
IB32	32 gal. Ingredient Bin (121 L)	4.28 Cubic feet (0,121) Cubic meters	215 lbs. (97,5 kg.)	160 lbs. (73 kg.)	22" x 24" x 23 <sup>1</sup> / <sub>4</sub> " (56 x 61 x 59 cm)	27.75 (7.50)
IB36	34 gal. Ingredient Bin (129 L)	4.54 Cubic feet (0,128) Cubic meters	252 lbs. (114 kg.)	180 lbs. (82 kg.)	15 <sup>1</sup> / <sub>2</sub> " x 29 <sup>1</sup> / <sub>2</sub> " x 28 <sup>5</sup> / <sub>8</sub> " (39 x 75 x 73 cm)	30 (8.51)
IB44	43 gal. Ingredient Bin (161 L)	5.69 Cubic feet (0,161) Cubic meters	320 lbs. (145 kg.)	230 lbs. (104 kg.)	18 <sup>1</sup> / <sub>2</sub> " x 29 <sup>1</sup> / <sub>2</sub> " x 28 <sup>5</sup> / <sub>8</sub> " (47 x 75 x 73 cm)	14 (0,24)

## Architect Specs

The Ingredient Bins shall be Cambro Model..., manufactured by Cambro Mfg. Co., Huntington Beach, CA 92648 U.S.A. Each unit shall be one piece, seamless, single-wall molded construction made of FDA Approved white polyethylene. Unit capacity shall range from 27 - 43 gallons (102 - 161 L) and/or 3.56 - 5.69 cu. ft. (0,100 - 0,161 cubic meters).

It shall have four each 3" (7,6 cm) casters with 1<sup>1</sup>/<sub>4</sub>" (3,2 cm) wide tread, 2 front swivel and 2 fixed, mounted on molded-in steel plates. It shall have an injection molded, transparent, slide-back polycarbonate lid. It shall not exceed 29" (73,6 cm) in height so that it can store under standard work tables. It shall be available in white only with a clear cover.

## Approvals



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 Telephone 714 848 1555 Toll Free 800 854 7631 Customer Service Department 800 833 3003



# INGREDIENT BINS AND CAMWEAR® DRY SCOOPS

## Ingredient Bins

- Store bulk dry ingredients such as flour and grain.
- Hygienic clear sliding lid reduces handling and allows for quick content identification.
- Bin made of FDA-accepted material so no liners are needed.
- Designed to fit under standard work tables.

3" Casters: 2 rear fixed, 2 front swivel.  
 .....  
 Color: White (148).  
 Cover Color: Clear (135).  
 .....  
 Scoops sold separately.



CODE	DIMENSIONS W x L x H	LIQUID CAPACITY	LID TYPE	DRY CAPACITY (SUGAR)	DRY CAPACITY (FLOUR)
IBS20	13" x 29½" x 28"	21 gal.	Two Piece Sliding Lid	170 lbs.	140 lbs.
IBS27	16⅝" x 29⅜" x 28"	27	Two Piece Sliding Lid	226	150
IBS37	21½" x 29½" x 28¼"	37	Two Piece Sliding Lid	314	225
IBSF27	13" x 30⅞" x 28½"	26.7	Two Piece Sliding Lid	216	150
IB32	22" x 24" x 23"	32	Single Flat Lid	215	160
IB36	15¼" x 29½" x 29"	34	Single Flat Lid	252	180
IB44	18½" x 29½" x 29"	42.5	Single Flat Lid	320	230

Case Pack: 1 InStock Color: White (148).

## Camwear Dry Scoops

- Virtually unbreakable Camwear will not dent, chip or rust.
- Molded-in sure grip handle includes a hole for hanging.
- Ideal for use with Cambro Ice Caddies and Ingredient Bins.

Color: Clear (135).  
 .....  
 NSF, NSF, NSF, and CA PROP 65 icons



CODE	APPROX. CAPACITY	CASE PACK
SCP6CW	6 oz.	12
SCP12CW	12	12
SCP24CW	24	12
SCP64CW	64	6

InStock Color: Clear (135).



**CAMBRO****Ingredient Bins****Slant Top**

Models IBS20 – 21 gallon (81 L)  
 IBS27 – 27 gallon (102 L)  
 IBS37 – 37 gallon (140 L)

**Features & Benefits**

- Stores and transports a wide variety of dry ingredients such as flour, sugar, rice or grains. Perfect for restaurants, food manufacturers or commissaries.
- Available in 21, 27 and 37 gallon (81, 102, 140 L) capacity to meet standard industry requirements for storage and transportation of bulk foods.
- One-piece, seamless single-wall polyethylene bin construction is extremely durable. Won't rust or corrode. Liquids and dry foods will not stick or seep between seams.
- FDA accepted material. Meets all food contact requirements and eliminates need for liners.
- Smooth interior and exterior are easy to clean.
- Injection molded Camwear® polycarbonate lids are transparent, break resistant and offer quick and easy identification of contents. Slide-back feature means easy access.
- Working height permits storage under standard work tables.
- Heavy-duty 3" (7,6 cm) casters, 2 front swivel, 2 fixed.
- No assembly required.
- Available in White (148) only with Clear (135) cover.

Item No. \_\_\_\_\_

Specifier Identification No. \_\_\_\_\_

Model No. \_\_\_\_\_

Quantity \_\_\_\_\_

**IBS20****IBS27****IBS37**

**Scoops not Included**  
**Approvals**

**CAMBRO**

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 Telephone 714 848 1555 Toll Free 800 854 7631 Customer Service Department 800 833 3003

# Ingredient Bins

## Slant Top

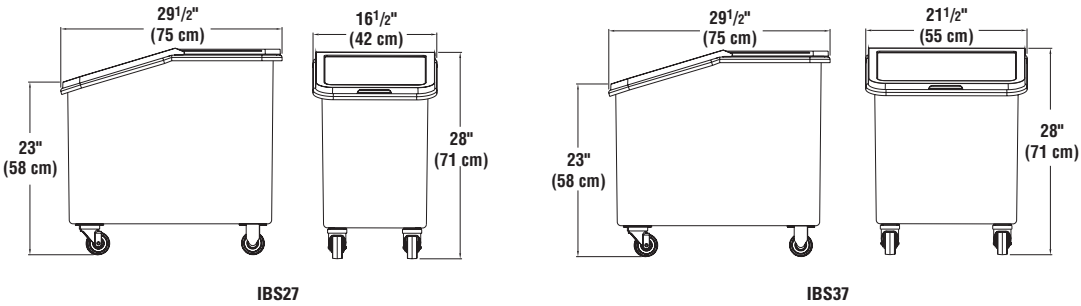
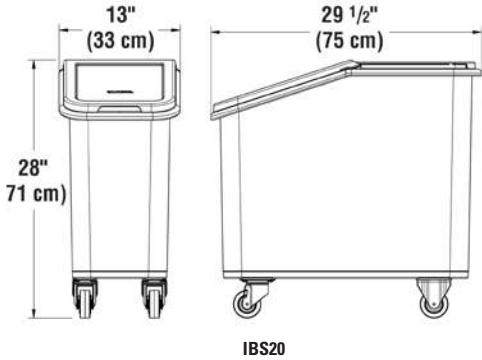
Models IBS20 – 21 gallon (81 L)  
 IBS27 – 27 gallon (102 L)  
 IBS37 – 37 gallon (140 L)

**Item No.** \_\_\_\_\_

**Specifier Identification No.** \_\_\_\_\_

**Model No.** \_\_\_\_\_

**Quantity** \_\_\_\_\_



### Specifications

Dimension Tolerance: +/- 1/4" (0,64 cm)

Code	Description	Volume Capacity	Load Capacity		Exterior Dimensions W x D x H	Case lbs./cube Kg/m <sup>3</sup>
			Sugar	Flour		
IBS20	21 gal. Ingredient Bin (81 L)	2.87 Cubic feet (0,081) Cubic meters	170 lbs. (77 kg.)	140 lbs. (63 kg.)	13" x 29 1/2" x 28" (33 x 75 x 71 cm)	28 (6,57) 13 (0,19)
IBS27	27 gal. Ingredient Bin (102 L)	3.98 Cubic feet (0,113) Cubic meters	226 lbs. (103 kg.)	150 lbs. (68 kg.)	16 1/2" x 29 1/2" x 28" (42 x 75 x 71 cm)	24 (7,50) 11 (0,22)
IBS37	37 gal. Ingredient Bin (140 L)	5.55 Cubic feet (0,157) Cubic meters	314 lbs. (142 kg.)	225 lbs. (102 kg.)	21 1/2" x 29 1/2" x 28" (55 x 75 x 71 cm)	28 (10,10) 13 (0,29)

### Architect Specs

The Ingredient Bins shall be Cambro Model..., manufactured by Cambro Mfg. Co., Huntington Beach, CA 92648 U.S.A. Each unit shall be one piece, seamless, single-wall molded construction made of FDA Approved white polyethylene. Unit capacity shall range from 21 - 37 gallons (81 - 140 L) and/or 2.87 - 5.55 cu. ft. (0,081 - 0,157 cubic meters).

It shall have four each 3" (7,6 cm) casters with 1 1/4" (3,2 cm) wide tread, 2 front swivel and 2 fixed. It shall have an injection molded, transparent, slide-back polycarbonate lid. It shall not exceed 29" (73,6 cm) in height so that it can store under standard work tables. It shall be available in white only with a clear cover.

### Approvals



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## Submittal Sheet

01/09/2023

### ITEM# 74 - WORK TABLE, STAINLESS STEEL TOP (1 EA REQ'D)

Eagle Group T3096SE-BS

Spec-Master® Series Work Table, 96"W x 30"D, 4-1/2"H backsplash, 14/300 series stainless steel top, rolled front edge, adjustable 18/300 series stainless steel undershelf with marine edge, Uni-Lok® gusset system, (6) stainless steel legs & adjustable bullet feet, NSF

The spec sheet for this item can be viewed on item 67)

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	1	E101A	Turn down back of splash per table with Z clip
Eagle Group	1	502943	Drawer Assembly, 20" x 15" x 5", 430 type stainless steel, removable drawer pan, hemmed safety pull handle (table must be field drilled for mounting)



Profit from the Eagle Advantage®

## Specification Sheet

Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

### Tier Drawers and Drawer Assemblies for Stainless Steel and Hardwood Tables

#### MODELS:

- |                                 |                                 |                                |
|---------------------------------|---------------------------------|--------------------------------|
| <input type="checkbox"/> 501572 | <input type="checkbox"/> 502972 | <input type="checkbox"/> NTD3  |
| <input type="checkbox"/> 502943 | <input type="checkbox"/> 606826 | <input type="checkbox"/> NTD3L |
| <input type="checkbox"/> 502946 | <input type="checkbox"/> 608115 | <input type="checkbox"/> TD3   |
| <input type="checkbox"/> 502947 | <input type="checkbox"/> 608116 | <input type="checkbox"/> TD3L  |
| <input type="checkbox"/> 502971 | <input type="checkbox"/> 608117 |                                |

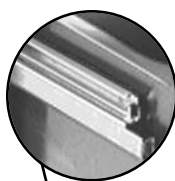


#TD3

#### Regular Tier Drawers

- Heavy gauge type 430 stainless steel cabinet with three roller-track drawers.
- Available with nylon feet or legs.
- Includes guides, zinc-plated full-extension slides, and stainless steel drawer.
- Hemmed safety pull handle on each drawer.
- All shipping weights are approximate.

model #	description	width x length x height		weight	
		in.	mm	lbs.	kg
TD3	3 drawers, with nylon feet	22½" x 24" x 22"	572 x 610 x 559	75	34.0
TD3L	3 drawers, with legs	22½" x 24" x 34½"	572 x 610 x 876	78	35.4



removable  
NSF  
drawer  
slide



#NTD3L

#### NSF-Approved Tier Drawers NSF

- Utilizes totally removable drawer slides certified by the National Sanitation Foundation.
- Otherwise, design and features are the same as tier drawers listed above.
- Hemmed safety pull handle on each drawer.
- Optional pan replacement available: Model #608120.

model #	description	width x length x height		weight	
		in.	mm	lbs.	kg
NTD3	3 drawers, with nylon feet	22½" x 24" x 22"	572 x 610 x 559	75	34.0
NTD3L	3 drawers, with legs	22½" x 24" x 34½"	572 x 610 x 876	78	35.4

#### Options / Accessories

- Drawer lock (suffix "-L")
- Pan replacement for NSF-Approved Tier Drawers
- Pan replacement for drawer assemblies

#### EAGLE GROUP

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For custom configuration or fabrication needs, contact our SpecFAB® Division.

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#### Certifications / Approvals



(only where noted)



AutoQuotes



EG10.13B Rev. 06/21

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Profit from the Eagle Advantage®

Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

## Tier Drawers and Drawer Assemblies

### Drawer Capacity Per Table

Drawers can be centered, left or right.

table length in. mm	15" x 20" (381 x 508mm) drawer capacity per table	20" x 20" (508 x 508mm) * drawer capacity per table
24" 610	0	0
30" 762	1 centered	0
36" 914	1 centered	1 centered
48" 1219	1 centered; or 1 left & 1 right	1 centered
60" 1524	1 centered; or 1 left & 1 right	1 centered; or 1 left & 1 right
72" 1829	3 (1 centered, 1 left, 1 right)	1 centered; or 1 left & 1 right
84" 2134	4	1 centered; or 1 left & 1 right
96" 2438	4 (2 left, 2 right)	2 (1 left, 1 right)
108" 2743	4 (2 left, 2 right)	4 (2 left, 2 right)
120" 3048	4 (2 left, 2 right)	4 (2 left, 2 right)
132" 3353	6 (3 left, 3 right)	4 (2 left, 2 right)
144" 3658	6 (3 left, 3 right)	4 (2 left, 2 right)

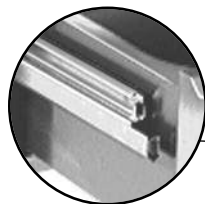
\* Holes are predrilled for 20" x 20" drawers only.



enclosed drawer assembly



SPEC-MASTER® heavy duty  
drawer assembly



removable NSF  
drawer slide



drawer assembly with  
NSF-approved slides

### Enclosed Drawer Assemblies **NSF**

- Removable drawer pan.
- Type 430 stainless steel assemblies.
- Hemmed safety pull handle on each drawer.

model #	width x length x height (drawer pan only)		weight lbs. kg	Optional Pan Replacement model #
	in.	mm		
502943 *	20" x 15" x 5"	508 x 381 x 127	35 15.9	608115
501572	20" x 20" x 5"	508 x 508 x 127	35 15.9	608116

\* Tables must be field drilled for mounting.

### Enclosed SPEC-MASTER® Heavy Duty Drawer Assemblies **NSF**

- Removable drawer pan.
- Type 304 stainless steel assemblies.
- Insulated front.
- Self-closing drawer slides that fully extend from housing.
- These drawer assemblies are stackable.

model #	width x length x height (drawer pan only)		weight lbs. kg	Optional Pan Replacement model #
	in.	mm		
502972 *	20" x 15" x 5"	508 x 381 x 127	40 18.1	608117
502971	20" x 20" x 5"	508 x 508 x 127	40 18.1	606826

\* Tables must be field drilled for mounting.

### Drawer Assemblies with NSF-Approved Slides **NSF**

- Removable drawer slides, making it easy to clean for complete sanitation.
- Type 430 stainless steel.
- Requires no tool.
- All-stainless steel housing and frame.
- Drawer consists of full-length front pull flange and removable drawer pan with large radius corners.
- Hemmed safety pull handle on each drawer.

model #	width x length x height (drawer pan only)		weight lbs. kg	Optional Pan Replacement model #
	in.	mm		
502947 *	20" x 15" x 5"	508 x 381 x 127	35 15.9	608115
502946	20" x 20" x 5"	508 x 508 x 127	35 15.9	608116

\* Tables must be field drilled for mounting.

### EAGLE GROUP

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## Submittal Sheet

01/09/2023

### ITEM# 75 - SHELVING, WALL MOUNTED (2 EA REQ'D)

Eagle Group WS1248-16/3

Shelf, wall-mounted, 48"W x 12"D, rolled frontedge, 1-1/2"H up-turn on sides & rear, includes stainless steel mounting brackets stud welded to shelf, 16/304 stainless steel construction, NSF

The spec sheet for this item can be viewed on item 15)

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	2		NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.

**Submittal Sheet**

01/09/2023

**ITEM# 76 - CAN OPENER (1 EA REQ'D)**

Edlund S-11WB

Can Opener, manual, 16" bar length, max can height of 13" dishwasher safe, rust proof, stainless steel without base, NSF certified

## ACCESSORIES

Mfr	Qty	Model	Spec
Edlund	1		5 year limited warranty, standard

# Edlund S-11 NSF Manual Can Openers

For the very highest standard in food safety and sanitation, the S-11 manual can opener has over 17 years of success in foodservice worldwide utilizing proprietary can opening technology. The patented S-11 has successfully opened nearly one billion cans without a single complaint – giving it a stainless reputation. Add in the industry's longest warranty and you've got an opener that's a cut above any other.



- 5-year warranty
- NSF Certified
- Dishwasher safe
- Made in U.S.A.
- Rustproof stainless steel construction
- Parts remove easily for replacement
- Tamper proof model also available
- Available with screw down base or clamp on model
- Standard size or with long bar for taller cans
- Patented



# Open up to a higher standard in food safety.



## Dishwasher Safe

Toss in the dishwasher for easy cleaning. The industry's first all-stainless can opener, the S-11 resists rust and stays looking new, no matter how many times it's washed.



## Fewer Parts

The S-11's advanced design means fewer parts than most other openers, and its patented Quick Change Mechanism makes knife and gear replacement fast and easy.

## Quick Change Mechanism

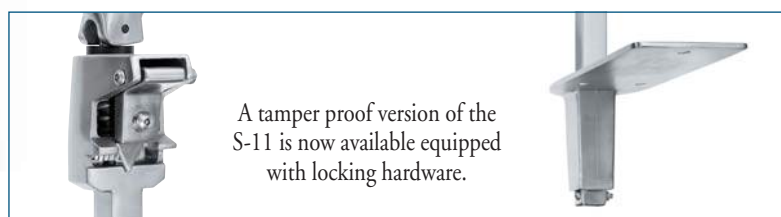
Makes gear replacement fast and easy.



S-11 with clamp base

Tamper proof S-11 opener with tamper proof base

ST-93 Rustproof can opener cleaning tool



A tamper proof version of the S-11 is now available equipped with locking hardware.

## SPECIFICATIONS:

MODEL #	DESCRIPTION	PRODUCT CODE	CASE CUBE FT <sup>3</sup> /M <sup>3</sup>	CASE WEIGHT LBS./KGS
S-11	Stainless Steel Can Opener With cast stainless steel base	15000	3.3/0.1	30/13.6
S-11 L	With long bar for cans up to 17" high (50cm)	15300	3.3/0.1	30/13.6
S-11 E	Comes complete with ST-93 cleaning tool and extra knife and gear	15400	3.3/0.1	31/14.1
S-11 C	Clamping Base Model Now available with clamp instead of screws Secures to underside of table	15020	3.3/0.1	30/13.6
S-11 CL	Clamping Base Model With long bar for cans up to 17" high (50cm)	15320	3.3/0.1	30/13.6
S-11 CE	Clamping Base Model complete with ST-93 cleaning tool and extra knife and gear	15420	3.3/0.1	32/14.5
S-11 WB	Without Base	15200	3.3/0.1	21/9.5
S-11 TP	Tamper Proof Opener With tamper proof base	15080	3.3/0.1	30/13.6
ST-93	Rustproof can opener cleaning tool	38500		.5/2

Note: S-11 Series standard length bar is 16" (40.6 cm) long. Extra long bar is 22" (55.9 cm) long.



**Edlund** We're in your kitchen.™

Edlund Company, Inc., 159 Industrial Parkway, Burlington, VT 05401 800-772-2126 www.edlundco.com

WARRANTY INFORMATION: THE EDLUND COMPANY WARRANTS THESE PRODUCTS TO BE FREE FROM DEFECTS IN MATERIAL AND WORKMANSHIP FOR A PERIOD OF ONE YEAR FROM DATE OF PURCHASE. THE COMPANY'S OBLIGATION UNDER THIS WARRANTY IS LIMITED TO REPAIRING OR REPLACING WITHOUT CHARGE ANY PART OR PARTS FOUND TO BE DEFECTIVE UNDER NORMAL USE. IT IS THE RESPONSIBILITY OF THE PURCHASER TO RETURN THE ENTIRE UNIT TO THE FACTORY, TRANSPORTATION CHARGES PREPAID. THIS WARRANTY DOES NOT COVER PARTS THAT MUST BE REPLACED UNDER NORMAL USE, INCLUDING KNIVES AND DRIVE GEARS ON CAN OPENERS. NO OTHER WARRANTY, WRITTEN OR VERBAL, IS AUTHORIZED BY THE COMPANY. WARRANTY INFORMATION OUTSIDE THE UNITED STATES MAY VARY, CONSULT YOUR DISTRIBUTOR.

12/07 ED01-4021

# NSF Manual Can Openers

## S-11 MANUAL CAN OPENERS

WITH 5 YEAR WARRANTY!



S-11 Made in U.S.A.

The most sanitary can opener in the world! Rustproof, NSF Certified and dishwasher safe. All stainless steel. Parts remove easily for replacement.

Model Number	Description	Product Code	Case Cube Ft <sup>3</sup> /M <sup>3</sup>	Master Case	Case Weight lbs./kgs
S-11	Stainless Steel Can Opener (NSF Certified) With cast stainless steel base	15000	3.3/0.1	3	30/13.6
S-11L	With long bar for cans up to 17" high (50 cm)	15300	3.3/0.1	3	30/13.6
S-11E	"Extra Value" comes complete with ST-93 cleaning tool and 1 extra knife and gear	15400	3.3/0.1	3	31/14.1
S-11C	Clamping Base Model (NSF Certified) Now available with clamp instead of screws. Secures to underside of table	15020	3.3/0.1	3	30/13.6
S-11CL	With long bar for cans up to 17" high (50 cm)	15320	3.3/0.1	3	30/13.6
S-11CE	"Extra Value" – Clamping Base Model complete with ST-93 cleaning tool and extra knife and gear.	15420	3.3/0.1	3	32/14.5
S-11WB	Without Base	15200	3.3/0.1	3	21/9.5
S-11TP	Tamper resistant opener with tamper proof base	15080	3.3/0.1	3	30/13.6

Note: S-11 has standard bar length of 16" (40.6 cm) long. Extra long bar is 22" (55.9 cm) long.

## U SERIES MANUAL CAN OPENERS

Edlund now offers the Universal Series Manual Can Openers. These can openers offer substantial improvements over our popular #1® and #2® models. The U-12 includes many of the same design features as our S-11 standard openers, with quick change gear, stainless steel shaft and pull pin for easy blade replacement. The base design features a replaceable insert for a tighter fit and easier slide action. Other base options are also available. NSF Certified.

Model Number	Description	Product Code	Case Cube Ft <sup>3</sup> /M <sup>3</sup>	Master Case	Case Weight lbs./kgs
U-12	Quick change NSF can opener with standard length bar and new plated base	14100	3.3/0.1	3	21/9.5
U-12WB	NSF Opener without base	14000	3.3/0.1	3	21/9.5
U-12S	NSF Opener with stainless steel base	14200	3.3/0.1	3	21/9.5
U-12C	NSF Opener with cast stainless steel clamp base	14010	3.3/0.1	3	22/9.9
U-12L	NSF Opener with long bar and plated steel base	14500	3.3/0.1	3	22/9.9
U-12SL	NSF Opener with long bar and stainless steel base	14600	3.3/0.1	3	22/9.9
U-12CL	NSF Opener with long bar and cast stainless steel clamp base	14300	3.3/0.1	3	23/10.4

Note: U-12 Series standard bar length is 16" (40.6 cm) long. Extra long bar is 22" (55.9 cm) long.



U-12 Made in U.S.A.



U-12 Made in U.S.A.

## SG-2 NSF STAINLESS MANUAL CAN OPENERS

WITH 2 YEAR WARRANTY!

For operators who only require a lighter duty manual can opener but want full stainless steel protection, Edlund introduces the SG-2 Model. The flagship of our popular G-2 Series Openers, this new model is all stainless steel, dishwasher safe, and features our patented quick change knife and gear system, and comes with a full two year warranty. A great opener for a Global Marketplace.

Model Number	Description	Product Code	Case Cube Ft <sup>3</sup> /M <sup>3</sup>	Master Case	Case Weight lbs./kgs
SG-2	NSF Stainless Opener with standard bar and stainless base	13100	3.3/0.1	3	18/8.1
SG-2C	NSF Stainless Opener with stainless clamp base	13200	3.3/0.1	3	20/9
SG-2L	NSF Stainless Opener with long bar and stainless base	13300	3.3/0.1	3	20/9
SG-2CL	NSF Stainless Opener with long bar and stainless clamp base	13400	3.3/0.1	3	22/9.8

Note: SG-2 Series standard bar length is 16" (40.6 cm) long. Extra long bar is 22" (55.9 cm) long.

Edlund blades are reversible for longer life and available through your dealer.



## Submittal Sheet

01/09/2023

### ITEM# 77 - WORK TABLE, STAINLESS STEEL TOP (3 EA REQ'D)

Eagle Group T3096SE

Spec-Master® Series Work Table, 96"W x 30"D, 14/300 series stainless steel top, rolled edge on front & back, adjustable 18/300 series stainless steel undershelf with marine edge, Uni-Lok® gusset system, (6) stainless steel legs & adjustable bullet feet, NSF

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	3	502943	Drawer Assembly, 20" x 15" x 5", 430 type stainless steel, removable drawer pan, hemmed safety pull handle (table must be field drilled for mounting)



Profit from the Eagle Advantage®

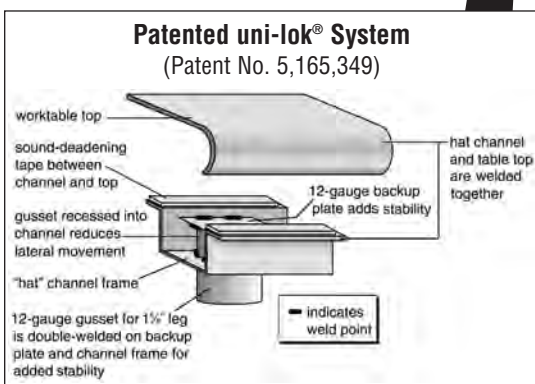
## Specification Sheet

### Short Form Specifications

Eagle worktables, Spec-Master® series, model \_\_\_\_\_.  
Top constructed of 14 gauge 300 series stainless steel, with 1½" roll on front and rear, and sides turned down 90°. Undershef is adjustable and constructed of 18 gauge 300 series stainless steel with marine edge. Top reinforced with stainless steel hat channels and sound deadened. Constructed with uni-lok® patented gusset system with the gussets recessed into the hat channels to reduce lateral movement. Legs are 1½" O.D., stainless steel, with stainless steel gussets and 1" stainless steel adjustable bullet feet.



worktable with flat top  
and undershef



### EAGLE GROUP

100 Industrial Boulevard, Clayton, DE 19938-8903 USA  
Phone: 302-653-3000 • Fax: 302-653-2065  
www.eaglegrp.com

Foodservice Division: Phone 800-441-8440

MHC/Retail Display Divisions: Phone 800-637-5100

For custom configuration or fabrication needs, contact our SpecFAB® Division.

Phone: 302-653-3000 • Fax: 302-653-2065 • e-mail: quotes@eaglegrp.com

Spec sheets available for viewing, printing or downloading from our online literature library at [www.eaglegrp.com](http://www.eaglegrp.com)

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Item No.: \_\_\_\_\_

Project No.: \_\_\_\_\_

S.I.S. No.: \_\_\_\_\_

## Worktables with Flat Top and Stainless Steel Base with Undershef—Spec-Master® Series

### MODELS:

<input type="checkbox"/> T2424SE	<input type="checkbox"/> T24144SE	<input type="checkbox"/> T30132SE	<input type="checkbox"/> T36144SE
<input type="checkbox"/> T2430SE	<input type="checkbox"/> T3030SE	<input type="checkbox"/> T30144SE	<input type="checkbox"/> T4848SE
<input type="checkbox"/> T2436SE	<input type="checkbox"/> T3036SE	<input type="checkbox"/> T3648SE	<input type="checkbox"/> T4860SE
<input type="checkbox"/> T2448SE	<input type="checkbox"/> T3048SE	<input type="checkbox"/> T3660SE	<input type="checkbox"/> T4872SE
<input type="checkbox"/> T2460SE	<input type="checkbox"/> T3060SE	<input type="checkbox"/> T3672SE	<input type="checkbox"/> T4884SE
<input type="checkbox"/> T2472SE	<input type="checkbox"/> T3072SE	<input type="checkbox"/> T3684SE	<input type="checkbox"/> T4896SE
<input type="checkbox"/> T2484SE	<input type="checkbox"/> T3084SE	<input type="checkbox"/> T3696SE	<input type="checkbox"/> T48108SE
<input type="checkbox"/> T2496SE	<input type="checkbox"/> T3096SE	<input type="checkbox"/> T36108SE	<input type="checkbox"/> T48120SE
<input type="checkbox"/> T24108SE	<input type="checkbox"/> T30108SE	<input type="checkbox"/> T36120SE	<input type="checkbox"/> T48132SE
<input type="checkbox"/> T24120SE	<input type="checkbox"/> T30120SE	<input type="checkbox"/> T36132SE	<input type="checkbox"/> T48144SE
<input type="checkbox"/> T24132SE			

### Tabletop

- Patented uni-lok® gusset system (patent #5,165,349): gussets are recessed into hat channel, reducing lateral movement.
- Top reinforced with welded-on hat channel.
- Sound-deadened between top and channels.
- 1½" (38mm)-diameter 180° rolled edges on front and rear. Ends are turned down 90° providing for flush installations when required.
- 14 gauge 300 series polished stainless steel.

### Adjustable Undershef

- 18 gauge 300 series stainless steel.
- Gusset welded to each corner.
- Heavy duty marine edge design.

### Legs—1½" (41mm)-diameter

- 24" to 36" (610 to 914mm)-wide units that are 96" (2438mm) and longer come with six legs or more. 48" (1219mm)-wide units that are 72" (1829mm) and longer come with six legs or more.
- Heavy gauge stainless steel.
- 1" (25mm) adjustable stainless steel feet.

### Options / Accessories

- |  |  |
|--|--|
| <input type="checkbox"/> Drawer                      | <input type="checkbox"/> Duplex receptacles                            |
| <input type="checkbox"/> Lock                        | <input type="checkbox"/> Pot rack                                      |
| <input type="checkbox"/> Casters                     | <input type="checkbox"/> Sink  |
| <input type="checkbox"/> Stainless steel bullet feet | <input type="checkbox"/> Additional undershef                          |
| <input type="checkbox"/> Overshelves                 | <input type="checkbox"/> Stabilizer Bar (for 30"- and 36"-wide tables) |

### Certifications / Approvals



### AUTOQUOTES



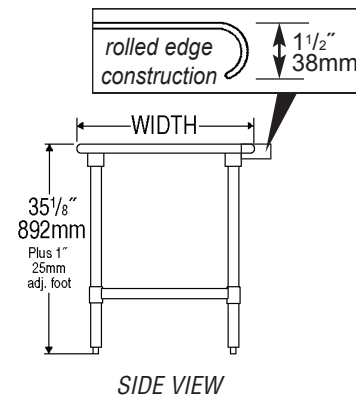
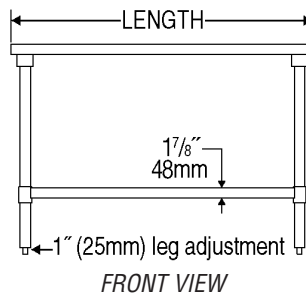
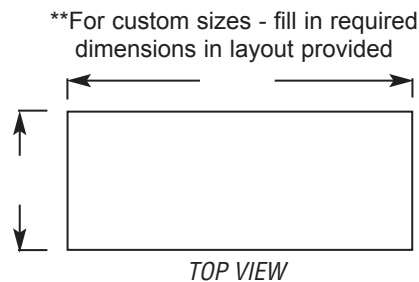
EG10.41C Rev. 09/15





Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

## Worktables with Flat Top and Stainless Steel Base with Undershelf—Spec-Master® Series



model #	# of legs	width		length		weight	
		in.	mm	in.	mm	lbs.	kg
T2424SE	4	24"	610	24"	610	46	20.9
T2430SE	4	24"	610	30"	762	50	22.7
T2436SE	4	24"	610	36"	914	55	24.9
T2448SE	4	24"	610	48"	1219	67	30.4
T2460SE	4	24"	610	60"	1524	78	35.4
T2472SE	4	24"	610	72"	1829	90	40.8
T2484SE	4	24"	610	84"	2134	103	46.3
T2496SE	6	24"	610	96"	2438	125	56.7
T24108SE	6	24"	610	108"	2743	144	65.3
T24120SE	6	24"	610	120"	3048	163	73.9
T24132SE	8	24"	610	132"	3353	186	84.4
T24144SE	8	24"	610	144"	3658	200	90.7
T3030SE	4	30"	762	30"	762	54	24.5
T3036SE	4	30"	762	36"	914	57	25.9
T3048SE	4	30"	762	48"	1219	75	34.0
T3060SE	4	30"	762	60"	1524	87	39.5
T3072SE	4	30"	762	72"	1829	101	45.8
T3084SE	4	30"	762	84"	2134	116	52.6
T3096SE	6	30"	762	96"	2438	139	63.1
T30108SE	6	30"	762	108"	2743	161	73.0
T30120SE	6	30"	762	120"	3048	182	82.6
T30132SE	8	30"	762	132"	3353	204	92.5
T30144SE	8	30"	762	144"	3658	224	101.6
T3648SE	4	36"	914	48"	1219	83	37.6
T3660SE	4	36"	914	60"	1524	97	44.0
T3672SE	4	36"	914	72"	1829	114	51.7
T3684SE	4	36"	914	84"	2134	132	59.9
T3696SE	6	36"	914	96"	2438	153	69.4
T36108SE	6	36"	914	108"	2743	180	81.6
T36120SE	6	36"	914	120"	3048	207	93.9
T36132SE	8	36"	914	132"	3353	234	106.1
T36144SE	8	36"	914	144"	3658	261	118.4
T4848SE	4	48"	1219	48"	1219	136	61.7
T4860SE	4	48"	1219	60"	1524	161	73.0
T4872SE	6	48"	1219	72"	1829	188	85.3
T4884SE	6	48"	1219	84"	2134	217	98.4
T4896SE	8	48"	1219	96"	2438	265	120.2
T48108SE	8	48"	1219	108"	2743	306	138.8
T48120SE	8	48"	1219	120"	3048	348	157.9
T48132SE	8	48"	1219	132"	3353	388	176.0
T48144SE	8	48"	1219	144"	3658	430	195.0

### EAGLE GROUP

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## Submittal Sheet

01/09/2023

### ITEM# 78 - WORK TABLE, STAINLESS STEEL TOP (3 EA REQ'D)

Eagle Group T3072SE-BS

Spec-Master® Series Work Table, 72"W x 30"D, 4-1/2"H backsplash, 14/300 series stainless steel top, rolled front edge, adjustable 18/300 series stainless steel undershelf with marine edge, Uni-Lok® gusset system, (4) stainless steel legs & adjustable bullet feet, NSF

The spec sheet for this item can be viewed on item 67)

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	3	E101A	Turn down back of splash per table with Z clip
Eagle Group	3	502943	Drawer Assembly, 20" x 15" x 5", 430 type stainless steel, removable drawer pan, hemmed safety pull handle (table must be field drilled for mounting)



## Submittal Sheet

01/09/2023

### ITEM# 79 - SHELVING, WALL MOUNTED (3 EA REQ'D)

Eagle Group WS1272-16/3

Shelf, wall-mounted, 72"W x 12"D, rolled frontedge, 1-1/2"H up-turn on sides & rear, includes stainless steel mounting brackets stud welded to shelf, 16/304 stainless steel construction, NSF

The spec sheet for this item can be viewed on item 15)

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	3		NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.



***Submittal Sheet***

01/09/2023

**ITEM# 80 - SPARE NO.**

<Spare No.>





***Submittal Sheet***

01/09/2023

**ITEM# 81 - SPARE NO.**

<Spare No.>



## Submittal Sheet

01/09/2023

### ITEM# 82 - WORK TABLE, STAINLESS STEEL TOP (2 EA REQ'D)

Eagle Group T3096SE-BS

Spec-Master® Series Work Table, 96"W x 30"D, 4-1/2"H backsplash, 14/300 series stainless steel top, rolled front edge, adjustable 18/300 series stainless steel undershelf with marine edge, Uni-Lok® gusset system, (6) stainless steel legs & adjustable bullet feet, NSF

The spec sheet for this item can be viewed on item 67)

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	2	E101A	Turn down back of splash per table with Z clip
Eagle Group	2	502943	Drawer Assembly, 20" x 15" x 5", 430 type stainless steel, removable drawer pan, hemmed safety pull handle (table must be field drilled for mounting)
Eagle Group	2	E15	Vertical tray dividers, four-section assembly, 3" on centers



## Submittal Sheet

01/09/2023

### ITEM# 83 - SHELVING, WALL MOUNTED (4 EA REQ'D)

Eagle Group WS1248-16/3

Shelf, wall-mounted, 48"W x 12"D, rolled frontedge, 1-1/2"H up-turn on sides & rear, includes stainless steel mounting brackets stud welded to shelf, 16/304 stainless steel construction, NSF

The spec sheet for this item can be viewed on item 15)

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	4		NOTE: Please add 10% to the list (current list /.90) for all orders shipping on or after March 1st, 2022.



## Submittal Sheet

01/09/2023

### ITEM# 84 - FOOD SLICER, ELECTRIC (1 EA REQ'D)

Hobart HS7-1

Heavy Duty Meat Slicer, automatic, 13" CleanCut™ removable knife with removal tool, burnished finish, (3) stroke lengths, & (4) stroke speeds, removable meat grip assembly, removable ring guard cover, product fence, single action top mounted sharpener with Borazon™ stones, manual lift lever, 1/2 hp motor, 5.6amps, 120v/60hz/1-ph, NSF cETLus

#### ACCESSORIES

Mfr	Qty	Model	Spec
Hobart	1		Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA

### ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	120	60	1	Cord & Plug			5.6		1/2		

**HOBART**701 S Ridge Avenue, Troy, OH 45374  
1-888-4HOBART • www.hobartcorp.com**HS7/HS7N  
SLICER****HOBART****STANDARD FEATURES****KNIFE**

- 13" CleanCut™ Knife
- Removable Ring Guard Cover
- Zero Knife Exposure
- Heavy-Gauge Stainless Steel Knife Cover
- Top-Mounted Borazon Stone Sharpener

**OPERATION**

- ½ H.P. Knife Drive Motor
- Timing Belt for Automatic Drive System
- Variable Four-Speed Automatic Carriage with Front Mounted Controls
- Three Stroke Lengths

**INTERLOCKS**

- Home-Start Position
- No-Volt Release

**HOUSING AND BASE**

- Burnished Aluminum Base
- Machine Grooves on Gauge Plate and Knife Cover
- Exclusive Tilting, Removable Carriage System
- Electroless Nickel Plated Single Slide Rod with Reservoir Wick in Transport
- Double-Action Indexing Cam
- Lift Assist Cleaning Leg
- Ergonomic-Style Handle
- Rear-Mounted, Removable Meat/Vegetable Grip Arm

**MODELS**

- HS7 – Automatic Slicer/Burnished Finish
- HS7N – Automatic Slicer/Burnished Finish with Non-Removable Knife Feature

**ACCESSORIES**

- Full Fence (standard on automatic models)
- Food Chute
- Debris Deflector

Specifications, Details and Dimensions on Inside and Back.

**HS7/HS7N SLICER**

# HS7/HS7N SLICER



701 S Ridge Avenue, Troy, OH 45374  
1-888-4HOBART • www.hobartcorp.com

## SOLUTIONS / BENEFITS

### PRECISION SLICING

#### 13" CleanCut™ Knife

- Super alloy edge stays sharp longer
- Lasts two to three times longer than carbon coated or stainless steel knives

#### Top Mounted Borazon Stone Sharpener

- Single-action sharpens and hones in just 15 seconds
- Removable and warewasher safe for easy cleaning and sanitation – can be used wet or dry
- Lifetime guaranteed Borazon sharpening stones provide maximum performance with reduced maintenance costs

#### Machined Grooves on Gauge Plate and Knife Cover

- Reduces drag for smoother slicing motion

#### Double-Action Indexing Cam

- The first full revolution of the indexing knob provides precise control of shaving, chipping and thin slicing
- The second revolution opens the gauge plate quickly for thicker slicing
- Gauge plate holds position for consistent, precision slicing

### EASY TO USE

#### ½ H.P. Knife Drive Motor

- Reserve power runs at 430 rpm for optimum results

#### Timing Belt Automatic Drive System

- Extends belt life while producing optimum slicing results
- Quieter operating slicer
- Four carriage speeds including 28, 38, 48 and 58 strokes per minute

#### Three Stroke Lengths

- Three stroke lengths ideal for a variety of products

#### Electroless Nickel Plated Single Slide Rod with Reservoir Wick in Transport

- Smooth operation with continuous lubrication of carriage rod

#### Zero Knife Exposure\*

- Knife edge is covered when sharpener is both mounted and removed, making cleaning easier
- Gauge plate remains closed during operation of sharpener

#### Home Start Position

- Carriage must be in 'home position' before the slicer will start

#### No Volt Release

- Slicer must be restarted if power fails or slicer is unplugged

### EASY TO CLEAN

#### Removable Knife Option\* – HS7

- Knife easily removes with patented removal tool
- Area within ring guard is open for faster cleaning
- Knife and tool are warewasher safe for easy cleaning and sanitation

#### Removable Ring Guard Cover\*

- Catches product debris around the knife for easy removal during cleaning
- Reduces time to 'floss' during cleaning

#### Exclusive Tilting, Removable Carriage System\*

- Tilt design allows for ease of mid-day cleaning
- Removable for complete cleaning and sanitation

#### Rear-Mounted, Removable Meat Grip Arm

- Opens up front of product tray for unobstructed loading
- Removable meat grip allows for easy cleaning

#### Lift Assist Cleaning Leg

- Gas assisted leg helps operator easily lift machine for cleaning underneath

#### Sanitary Burnished Aluminum Base

- Limited cracks/crevices or bolt holes where product can lodge and bacteria may grow
- Easy clean up and durable finish

\*Feature unique to Hobart



701 S Ridge Avenue, Troy, OH 45374  
1-888-4HOBART • www.hobartcorp.com

## HS7/HS7N SLICER

### SPECIFICATIONS

#### KNIFE

**13" CleanCut Knife:** The knife is approximately 13 inches, constructed of 304L stainless steel and high performance Stellite alloy. Knife cover is retained magnetically, and is quickly removed by pulling straight back on the top cover knob.

**Removable Knife Option HS7:** The patented knife removal tool covers the knife edge and safely removes knife from gauge plate to allow for thorough cleaning.

**Removable Ring Guard Cover:** Fits on top of ring guard to catch food debris. When removed, reveals a 0.12" space between knife and guard for easier flossing. Ring guard is made with Zytel™ plastic and can be washed in warewasher or three compartment sink.

**Zero Knife Exposure:** Knife edge is not exposed during cleaning or sharpening procedures.

**Top Mounted Borazon Stone Sharpener:** Single action operation utilizing two Borazon stones to sharpen and hone in five seconds. Removable, top mounted and warewasher safe. When sharpener is removed for cleaning, knife edge is completely shielded. Borazon stones have a lifetime guarantee.

#### MOTOR

**Poly V-Belt Knife Drive System:** Knife is driven by a Hobart Poly V belt and runs at 430 rpm for optimal performance.

**Four Stroke Speeds:** Stroke speed can be set to 28, 38, 48 and 58 strokes per minute.

**½ H.P. Knife Drive Motor:** ½ H.P. permanently lubricated ball bearings. Single phase capacitor-start, induction run.

#### INTERLOCKS

**Home Start Position:** Home-start ensures carriage is in a convenient position before starting the slicer.

**No Volt Release:** In the event of a power loss, slicer must be restarted before operation can continue.

#### HOUSING AND BASE

**Sanitary Burnished Aluminum Base:** One-piece base has fewer places to harbor soil and is easier to clean. Limits holes or crevices in which food can lodge.

**Finish:** Stainless steel top cover, anodized aluminum product tray and gauge plate.

**Exclusive Tilting, Removable Carriage System:** Aluminum product tray tilts easily for mid-day cleaning and is removable for thorough cleaning and sanitation procedures. The carriage has 12.5" manual travel.

**Electroless Nickel Plated Single Slide Rod with Reservoir Wick in Transport:** Transport slide rod is E-Nickel electroless plated. Slide rod bearings feature an oil reservoir/oil wick.

**Double-Action Indexing Cam:** A solid construction index knob moves the gauge plate via a barrel cam ensuring consistent slice thickness across machine and over time. First revolution of index cam for precision slicing; second revolution for thicker slicing selection.

**Lift Assist Cleaning Leg:** Gas assisted leg helps operator easily lift machine for cleaning underneath.

**Ergonomic Style Handle:** Specially shaped and positioned for ease of use during manual operation.

**Rear Mounted, Removable Meat Grip Arm:** Rear mounted grip is high strength thermoplastic. Swings out of way when not in use.

**Electrical Specification:** 120/60/1; 5.6 Amps.

**Switch:** Moisture protected push button switch.

**Cord & Plug:** 6-foot, three-wire power supply cord and plug. Plug not furnished on export models.

**Capacity:** The carriage will take food up to 5¾" x 10¾" rectangle or 7.5" in diameter.

**Gauge Plate:** Gauge plate is a heavy aluminum extrusion with machined grooves for smooth feeding. Adjustable to cut any thickness of slice up to 1".

**Warranty:** All parts and service coverage for one year including knife. Lifetime guarantee on Borazon stones in the sharpening system.

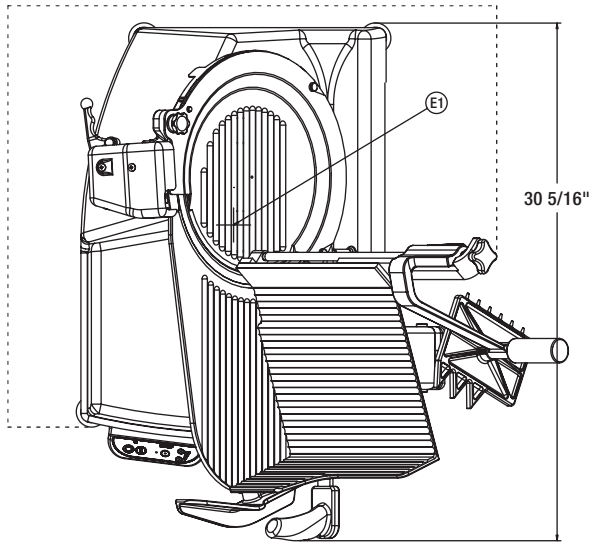
**Shipping Weight:** 138 lbs.

# HS7/HS7N SLICER



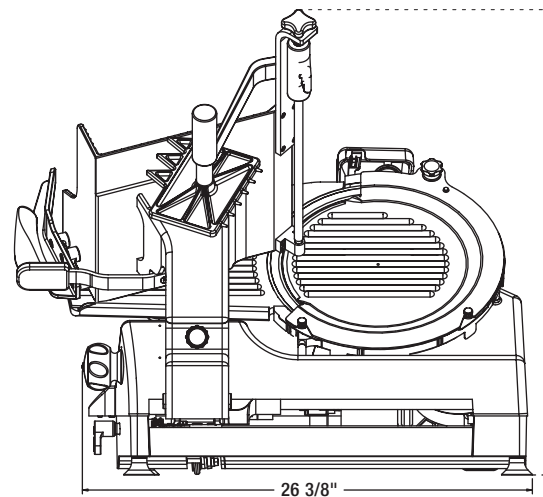
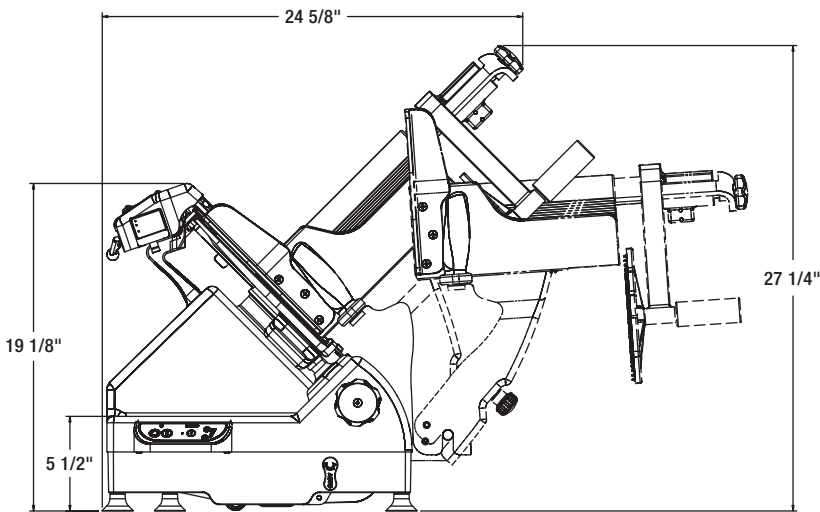
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## DETAILS AND DIMENSIONS



ELECTRICAL AND GROUNDING CONNECTIONS MUST COMPLY WITH THE APPLICABLE PORTIONS OF THE NATIONAL ELECTRICAL CODE AND/OR OTHER LOCAL ELECTRICAL CODES.

E1 - ELECTRICAL CONNECTIONS



As continued product improvement is a policy of Hobart, specifications are subject to change without notice.





## Submittal Sheet

01/09/2023

### ITEM# 85 - FOOD PROCESSOR, BENCHTOP / COUNTERTOP (1 EA REQ'D)

Hobart FP41-1

Food Processor, 4 qt. bowl design, 1725 rpm, stainless steel bowl with see-thru cover, bowl-scrapers, direct drive motor, triple safety interlocks, anodized aluminum base, rubber ft, (unit only) 120/60/1, 3/4 hp, 8' cord with plug

#### ACCESSORIES

Mfr	Qty	Model	Spec
Hobart	1		Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA

### ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	120	60	1	Cord & Plug					3/4		

**HOBART**701 S Ridge Avenue, Troy, OH 45374  
1-888-4HOBART • www.hobartcorp.com**FP41 BOWL-STYLE  
FOOD PROCESSOR****HOBART****STANDARD FEATURES**

- ¾ H.P. Direct Drive Motor
- Patented Bowl Scraper
- Durable Xylex Cover
- Stay Sharp Knife Blades
- Knife Speed of 1725 RPM
- Triple Safety Interlock
- User-Friendly Controls
- Compact Design
- Anodized Aluminum Base

**MODEL**

- FP41 – Hobart 4 Quart, Single Speed Bowl-Style Food Processor

Specifications, Details and Dimensions on Inside and Back.

**FP41 BOWL-STYLE FOOD PROCESSOR**

# FP41 BOWL-STYLE FOOD PROCESSOR

## HOBART

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### SOLUTIONS/BENEFITS

#### Direct Drive Motor

Durability

- ¾ H.P., 8.0 rated amps, direct driven.
- Prevents stalling and slipping.

#### Patented Bowl-Scraper

Labor savings

- No need to stop unit and scrape side of bowl.

#### Xylex Cover with Bowl Gasket

Durability, ease of use

- See-through design allows continuous view of product. Large tube feed makes it easy to add ingredients while processing.

#### Stay Sharp Knives

Consistency, productivity

- Wider knife blades cut through more product in less time.

#### 1725 RPM Knife Speed

Performance

- Ideal speed for emulsifying and pureeing foods.

#### Triple Safety Interlock

Safety

- Adds protection by preventing blade rotation until the lock arm, bowl and cover are in proper position.

#### User Friendly Controls

Ease of use

- Large control handle is on left side to leave the right hand free for ingredient feeding.
- Controls include ON, OFF and PULSE setting.

#### Compact Design

Reduce space requirement

- Occupies minimal counter space.
- Handles are molded on both sides of housing for ease of moving unit.

#### Anodized Aluminum Base with See-Through Top Cover

Durability, improved sanitation

- Easy cleanup and durable finish.
- Rubber feet on base prevents movement.

### SPECIFICATIONS

**Motor:** ¾ H.P.

**Electrical:** 120/60/1, 8 rated amps.

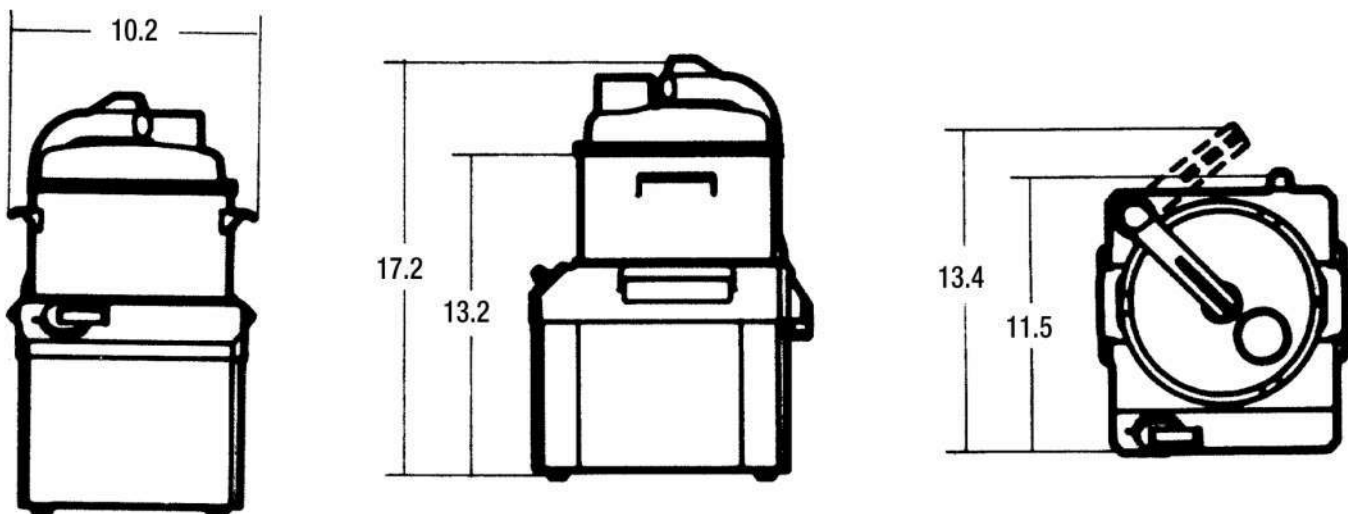
**Cord and Plug:** 3 conductor power cord (18 AWG) which is 8 feet in length.

**Switch:** ON, OFF and PULSE switch.

**Footprint:** 10.2" W x 17.2" H x 11.5" D (13.4" D with safety arm swing).

**Finish:** Anodized aluminum with Xylex top cover.

### DETAILS AND DIMENSIONS



As continued product improvement is a policy of Hobart, specifications are subject to change without notice.



## Submittal Sheet

01/09/2023

### ITEM# 86 - FOOD PROCESSOR, BENCHTOP / COUNTERTOP (1 EA REQ'D)

Hobart FP350-1

Food Processor - Unit Only, angled continuous feed design, full-size hopper, 26 lb per/min production cap., 430 rpm, stainless steel cutting surfaces, planetary gear transmission, triple safety interlocks, aluminum housing, rubber feet, 120/60/1, 1 HP, 10 amps, UL, NSF

#### ACCESSORIES

Mfr	Qty	Model	Spec
Hobart	1		Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA
Hobart	1	3SLICE-1/8-SS	1/8" Slicing Plate (3mm), stainless steel
Hobart	1	3SLICE-5/32-SS	5/32" Slicing Plate (4mm), stainless steel
Hobart	1	3SLICE-3/8-SS	3/8" Slicing Plate (10mm), stainless steel
Hobart	1	3JUL-5/64-SS	5/64" Julienne Plate (2mm), stainless steel
Hobart	1	3SHRED-1/8-SS	1/8" Shredder Plate (3mm), stainless steel
Hobart	1	3SHRED-5/32-SS	5/32" Shredder Plate (4mm), stainless steel
Hobart	1	S35DICE-3/8	3/8" Dicer Plate (10mm), stainless steel (for use with 3-10mm slicer plate)
Hobart	1	S35DICE-1/2	1/2" Dicer Plate (12.5mm), stainless steel (for use with 3-10mm slicer plate)

## ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	120	60	1	Cord & Plug			10		1		

**HOBART**701 S Ridge Avenue, Troy, OH 45374  
1-888-4HOBART • www.hobartcorp.com**FP350  
FOOD PROCESSOR****HOBART****STANDARD FEATURES**

- Red OFF, Green ON Button
- Compact Design
- Angled Front
- Planetary Drive
- Large Full Size Feed Hopper
- All Aluminum Hopper and Housing
- Double Interlock Switch
- Plate Speed of 430 RPMs
- Decoring Screw

**ACCESSORIES**

- 3-Pack Plates:  $\frac{1}{16}$ ,  $\frac{5}{32}$  slicer plates,  $\frac{5}{16}$  shredder plate, 1 wall rack
- 6-Pack Plates:  $\frac{1}{16}$ ,  $\frac{5}{32}$ ,  $\frac{3}{8}$ ,  $\frac{7}{32}$  slicer plates,  $\frac{5}{16}$  shredder plate and  $\frac{3}{8}$  dicer plate, 2 wall racks
- 3-Peg Wall Rack: designed to hold three plates for additional plate storage
- Slicer Plates:  $\frac{1}{16}$ ,  $\frac{1}{8}$ ,  $\frac{5}{32}$ ,  $\frac{7}{32}$ ,  $\frac{5}{16}$ ,  $\frac{3}{8}$ ,  $\frac{9}{16}$ ;  $\frac{3}{16}$  crimping plate
- Julienne Plates:  $\frac{5}{64}$ ,  $\frac{5}{32}$ ,  $\frac{7}{32}$ ,  $\frac{3}{8}$
- Dicer Grids:  $\frac{7}{32}$ ,  $\frac{3}{8}$ ,  $\frac{1}{2}$ ,  $\frac{5}{8}$ ,  $\frac{3}{4}$ , and 1
- Shredder Plates:  $\frac{1}{16}$ ,  $\frac{3}{32}$ ,  $\frac{1}{8}$ ,  $\frac{3}{16}$ ,  $\frac{5}{16}$ ,  $\frac{7}{32}$
- Grater Plate: Fine, Hard Cheese
- French Fry:  $\frac{3}{8}$
- Machine Table: Adjustable height table to hold Food Processor
- Adjustable height stainless steel lug cart
- Stainless steel receiving pan
- Plastic receiving pan

**MODELS**

- FP350 Continuous Feed Full Hopper Food Processor

Specifications, Details and Dimensions on Inside and Back.

**Standard with Pusher Plate****FP350 FOOD PROCESSOR**

# FP350 FOOD PROCESSOR

## HOBART

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### SOLUTIONS/BENEFITS

#### Red OFF, Green ON Button

Ease of use

- Operator can readily recognize

#### Compact Design

Ease of use, small footprint, reduced labor, increased sanitation and productivity

- Occupies minimal counter space
- Unit and receiving pan fit on 27" deep counter
- Plates remove in seconds
- Feed hopper removes without tools for ease of cleaning
- Produces consistent quality product results in seconds
- Production capability for 26 lbs. per minute

#### Angled Front

Operator convenience, ease of use

- 45° angle for ease of product loading
- Helps to reduce operator fatigue

#### Planetary Drive

Performance, reliability

- Helps to prevent stalling under heavy loads
- No rest times required between loads

#### Large Full Size Feed Hopper

Flexibility, convenience, reduced labor

- Supports processing capabilities for large variety of products
- Design permits continuous cutting of long products
- Eliminates precutting

#### All Aluminum Hopper and Housing

Durability, sanitation

- Anodized finish resists harsh cleaners
- Easy clean up

#### Double Interlock Switch

Protection

- Prevents machine from running when pusher plate swings away or is open

#### Plate Speed of 430 RPM

Product quality and consistency

- Precise cutting and dicing action without bruising or mashing of products

#### Decoring Screw

Quality, consistency

- Deflects products away from the plate hub for complete processing

### SPECIFICATIONS

**DESIGN:** Compact, conveniently designed at 45° angle for operator convenience. Base occupies minimal counter space. Housing constructed of anodized aluminum with rubber feet on base to prevent movement or skidding. Removable hopper front is burnished aluminum.

**ELECTRICAL:** 120/60/1, 3 Conductor power cord (14 AWG) is 6 feet in length.

**MOTOR:** 10 amps. Gear driven operating at 430 RPM output. 1 H.P. with overload protection.

**SWITCHES:** Easy to operate (red) OFF and (green) ON switch. Pusher plate and hopper front are interlocked.

**STANDARD EQUIPMENT:** Basic unit comes with deflector plate, decoring screw and cleaning brush.

**WARRANTY:** Unit has full one-year warranty on parts, labor and mileage against manufacturer's defects. Service contracts are available.

**CUTTING TOOLS:** The plates feature stainless steel construction with cutlery grade stainless steel knives. Plate combinations for dicing are shown in the chart to the right.

**WEIGHT:** Net - 71 lbs. Approximate Shipping - 77 lbs.

FP350 & FP400 Food Processors												
	S35DICE-7/32	S35DICE-9/32	S35DICE-3/8	S35DICE-1/2	S35DICE-1/2LOW	S35DICE-5/8	S35DICE-5/8LOW	S35DICE-3/4	S35DICE-3/4LOW	S35DICE-1	S35DICE-1LOW	S3FRY-3/8
3SLICE-1/32-SS												
3SLICE-1/16-SS												
3SLICE-1/8-SS	✓	✓	✓	✓		✓		✓		✓		
3SLICE-5/32-SS	✓	✓	✓	✓		✓		✓		✓		
3SLICE-7/32-SS	✓	✓	✓	✓		✓		✓		✓		
3SLICE-5/16-SS		✓	✓	✓		✓		✓		✓		
3SLICE-3/8-SS			✓	✓		✓		✓		✓		✓
3SLICE-9/16AL							✓		✓		✓	
35SFSLC-5/16		✓	✓	✓		✓		✓		✓		
35SFSLC-3/8			✓	✓		✓		✓		✓		
35SFSLC-1/2					✓		✓					
35SFSLC-5/8							✓					



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## FP350 FOOD PROCESSOR

### FOOD PROCESSOR ACCESSORIES

A wide variety of plates are available to tackle any food processing application. The construction of all accessories makes them dishwasher safe.

#### Slicer Plates:

Standard Slicing & Crimping Slicing Plates are used for cutting of soft or hard fruits and vegetables. The formed stainless steel plates with stainless steel hub and drive slot provides a strong, rigid mounting for repeatable operation. Cutlery grade stainless steel knives give sharp, reliable, long lasting cuts to any product. The knives are removable for fast, easy, cost effective replacement of these wear items while reusing the plate. Some plates have double knives for higher volume operations. Straight or decorative crinkle cut blades are available. These plates may be used in conjunction with suitable dicing grids for cubing of products.



#### Fine Slicer Plates:

These Fine Slicer Plates are used for cutting soft or hard fruits and vegetables. The plate is machined from a special aluminum alloy designed to withstand dishwasher cleaning. The round edge cutlery grade stainless steel knife slices through product cleanly for reliable, repeatable cutting action. The knife is removable for fast, easy, cost effective replacement of this wear surface while reusing the plate.



#### Soft Slicer Plates:

The Soft Slicer Plates are specifically designed for more delicate fruits and vegetables such as tomatoes, bananas, plantains, kiwi, etc. The plate is machined from a special aluminum alloy designed to withstand dishwasher cleaning. The straight edge knife and plate configuration cleanly cut through the delicate fruits and vegetables without damaging the product. The knife is removable for fast, easy, cost effective replacement of this wear surface while reusing the plate.



#### Julienne Plates:

Julienne Cutter Plates are suitable for firm products and are often used for soups, stews, French fries, and decorations. The plate creates long, square, curved strings of product. The formed stainless steel plates with stainless steel hub and drive slot provides a strong, rigid mounting for repeatable operation. Cutlery grade stainless steel knives give sharp, reliable, long lasting cuts. The julienne cutter knife unit is removable for fast, easy, cost effective replacement of these wear items while reusing the plate.



#### Shredder Plates:

Shredder plates are used for cheese, cabbage, nuts, dry bread, etc. The cast stainless steel frame, hub, and drive slot provide a strong, rigid mounting for repeatable operation. The stainless steel cutting plate gives sharp shredding action to the product. The cutting plate is removable for fast, easy, cost effective replacement of this wear surface while reusing the mounting frame.

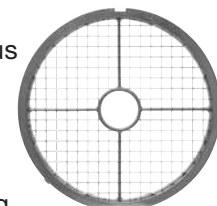


#### Grater Plates:

Grater plates may be used for hard dry cheese, carrots, potatoes, cabbage, dry bread, etc. The grater plate creates a fine granular/powdery product. The cast stainless steel frame, hub, and drive slot provide a strong, rigid mounting for repeatable operation. The stainless steel cutting plate gives sharp grating action to the product. The cutting plate is removable for fast, easy, cost effective replacement of this wear surface while reusing the mounting frame.

#### Dicing Grids:

Dicing grids are used in conjunction with slicing plates to produce various sized cube and rectangular shaped products for stews, salads, soups, and a wide variety of other applications. The dicing grid frame is cast stainless steel and provides a strong, rigid mounting for repeatable operation. The grid knives are cutlery grade stainless steel and give sharp cutting action to the product for precise, repeatable control of the product shape. The cutting knife set is removable for fast, easy, cost effective replacement of these wear surfaces while reusing the mounting frame.

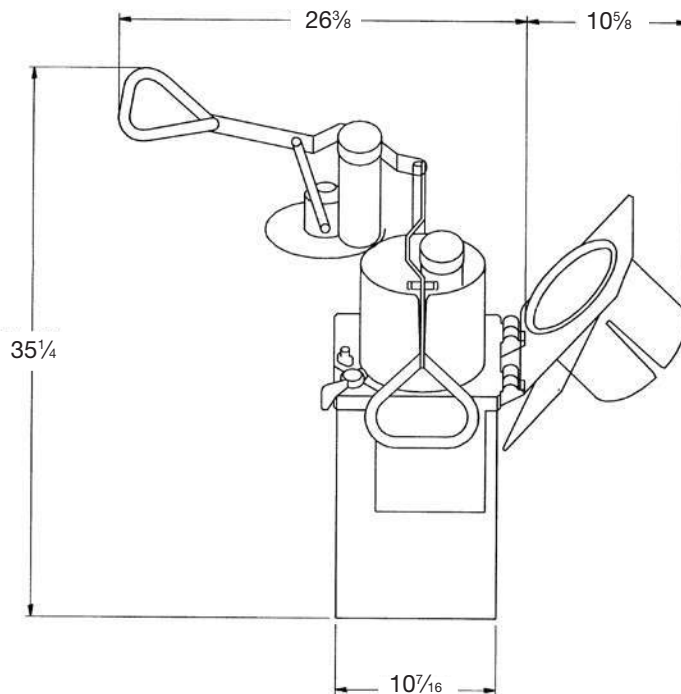
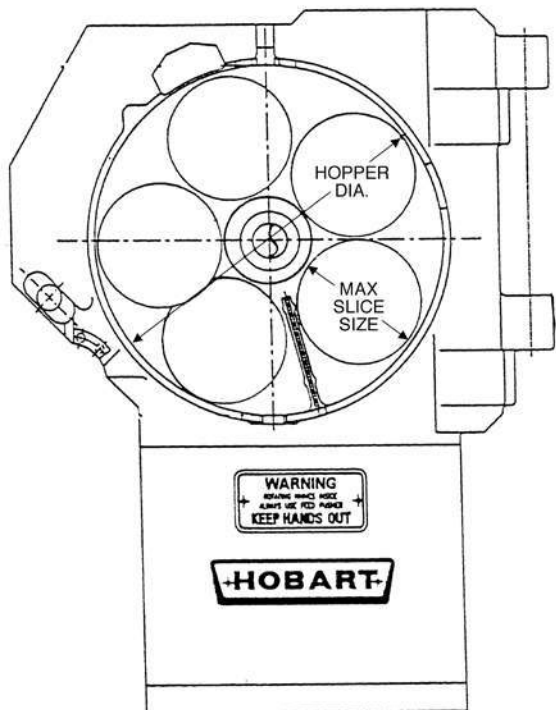


# FP350 FOOD PROCESSOR



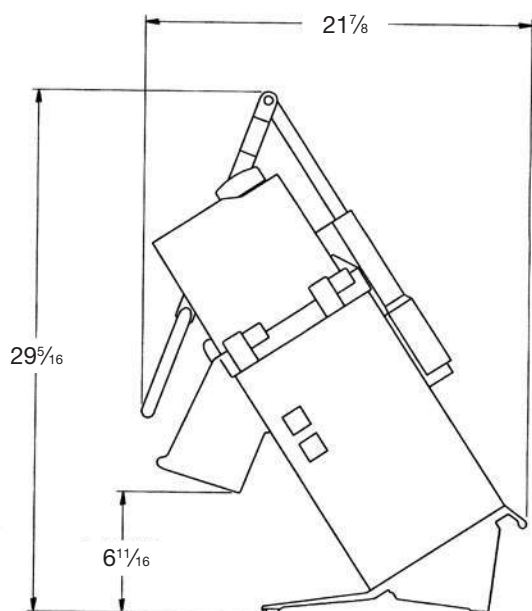
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## DETAILS AND DIMENSIONS

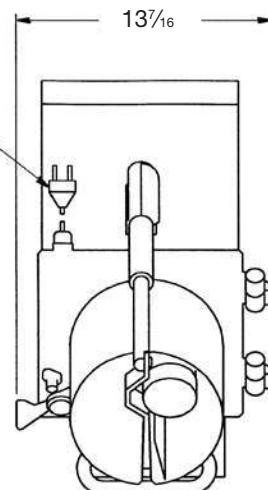


### FP350

Hopper Diameter	7 7/8"
Maximum Slice Size	3"
Usable Depth	7"
Feed Tube Diameter	2 5/16"



6 FT. CORD MIN.  
WITH NEMA 5-15P PLUG



As continued product improvement is a policy of Hobart, specifications are subject to change without notice.





***Submittal Sheet***

01/09/2023

**ITEM# 87 - SPARE NO.**

<Spare No.>



***Submittal Sheet***

01/09/2023

**ITEM# 88 - SPARE NO.**

<Spare No.>



***Submittal Sheet***

01/09/2023

**ITEM# 89 - SPARE NO.**

<Spare No.>



**Submittal Sheet**

01/09/2023

**ITEM# 90 - WALK IN MEAT COOLER (1 EA REQ'D)**

Kolpak

ACCESSORIES

Mfr	Qty	Model	Spec
Kolpak	1		3 HP warranty - \$426 3/4 HP warranty - \$207 3/4 HP warranty - \$207



***Submittal Sheet***

01/09/2023

**ITEM# 91 - WALK IN PRODUCE COOLER (1 EA REQ'D)**

Kolpak

price included in item #90



***Submittal Sheet***

01/09/2023

**ITEM# 92 - WALK IN FREEZER (1 EA REQ'D)**

Kolpak

price included in item #90



## Submittal Sheet

01/09/2023

### ITEM# 93 - PRODUCE AND MEAT COOLER SHELVING (1 LT REQ'D)

Eagle Group

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	16	QPF-2460E-GL-X	QuadPLUS™ Shelf Mat, louvered, 60"W x 24"D, green polymer mat with MICROGARD® antimicrobial protection, wire QuadTruss® frame with EAGLEgard® hybrid epoxy finish, (4) split sleeves, NSF (FLYER)
Eagle Group	16	QPF-2448E-GL-X	QuadPLUS™ Shelf Mat, louvered, 48"W x 24"D, green polymer mat with MICROGARD® antimicrobial protection, wire QuadTruss® frame with EAGLEgard® hybrid epoxy finish, (4) split sleeves, NSF (FLYER)
Eagle Group	32	P74-E-X	Post, stationary, 74"H, grooved in 1" increments, includes post cap & leveling bolt, EAGLEgard® hybrid epoxy finish with MICROGARD® antimicrobial protection, NSF (FLYER)

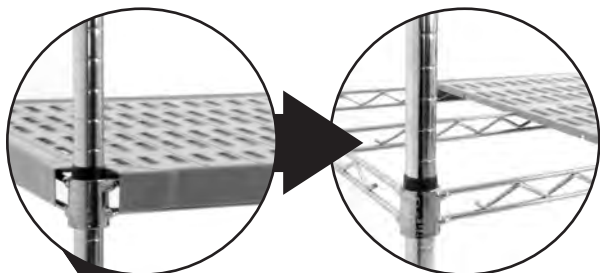


Profit from the Eagle Advantage®

## Specification Sheet

### Short Form Specifications

Eagle QuadPLUS®, model \_\_\_\_\_ . Blue or green polymer shelf mat available with standard wire truss frame. Pack of four split sleeves per truss frame. Blue mats include truss frames with chrome finish or Valu-Master® gray epoxy. Green mats include truss frames with EAGLEgard® green or Valu-Gard® green epoxy. Louvered and solid mats available.



QuadPLUS® shelf mat removed, showing standard wire truss frame



shelf unit with QuadPLUS®

### Options / Accessories

- Dividers
- Wire Baskets

### EAGLE GROUP

100 Industrial Boulevard, Clayton, DE 19938-8903 USA

Phone: 302-653-3000 • Fax: 302-653-2065

www.eaglegrp.com

Foodservice Division: Phone 800-441-8440

MHC/Retail Display Divisions: Phone 800-637-5100

For custom configuration or fabrication needs, contact our SpecFAB® Division.

Phone: 302-653-3000 • Fax: 302-653-2065 • e-mail: quotes@eaglegrp.com

Spec sheets available for viewing, printing or downloading from our online literature library at [www.eaglegrp.com](http://www.eaglegrp.com)

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Item No.: \_\_\_\_\_  
Project No.: \_\_\_\_\_  
S.I.S. No.: \_\_\_\_\_

## QuadPLUS® Polymer Shelf Mats with Standard Wire Truss Frames

### MODELS:

- |                                    |                                    |
|------------------------------------|------------------------------------|
| <input type="checkbox"/> QPF-18*BL | <input type="checkbox"/> QPF-18*GL |
| <input type="checkbox"/> QPF-21*BL | <input type="checkbox"/> QPF-21*GL |
| <input type="checkbox"/> QPF-24*BL | <input type="checkbox"/> QPF-24*GL |
| <input type="checkbox"/> QPF-18*BS | <input type="checkbox"/> QPF-18*GS |
| <input type="checkbox"/> QPF-21*BS | <input type="checkbox"/> QPF-21*GS |
| <input type="checkbox"/> QPF-24*BS | <input type="checkbox"/> QPF-24*GS |

\* See charts on back for complete model numbers.

### Features

- Standard wire truss frames with choice of blue or green polymer shelf mats.
- Mats snap into the truss frame.
- Truss frames and shelves, adjustable at 1" increments, can be fitted onto the same shelf unit.
- Injection-molded polypropylene mats feature MICROGARD® antimicrobial protection against bacteria, mold and mildew.
- 800-lb. weight capacity for shelves up to 48", 600 lbs. for shelves 54" through 72" long—evenly distributed static load.
- Louvered and solid mats available.
- Easy assembly—no tools required.
- Easy cleaning.
- Dishwasher-safe.
- Included with blue shelf mats are truss frames coated with choice of chrome finish or Valu-Master® gray epoxy. Truss frames included with green shelf mats are coated with choice of EAGLEgard® green or Valu-Gard® green epoxy.
- Set of four split sleeves (included with each truss frame) snap onto Eagle's 1"-diameter posts.
- Temperature rating: -Up to 200°F\* for intermittent exposure to cleaning, such as in a dishwasher.

\* Temperature rating of -20°F to 125°F under continuous use.

### Certifications / Approvals



### AUTOQUOTES



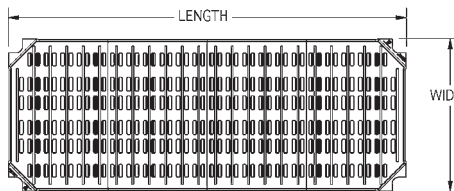




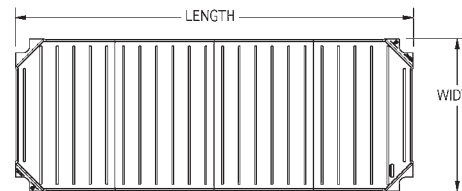
Profit from the Eagle Advantage®

Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

All models listed in the charts below include one standard truss frame and louvered or solid shelf mats.



TOP VIEW OF LOUVERED MATS



TOP VIEW OF SOLID MATS

**QuadPLUS® with Standard Wire Truss Frames and Green Shelf Mats**

width x length in. mm	...w/EAGLEgard® green epoxy		...w/Valu-Gard® green epoxy	
	w/louvered mats model #	with solid mats model #	w/louvered mats model #	with solid mats model #
18" x 24"	QPF-1824E-GL	QPF-1824E-GS	QPF-1824VG-GL	QPF-1824VG-GS
18" x 30"	QPF-1830E-GL	QPF-1830E-GS	QPF-1830VG-GL	QPF-1830VG-GS
18" x 36"	QPF-1836E-GL	QPF-1836E-GS	QPF-1836VG-GL	QPF-1836VG-GS
18" x 42"	QPF-1842E-GL	QPF-1842E-GS	QPF-1842VG-GL	QPF-1842VG-GS
18" x 48"	QPF-1848E-GL	QPF-1848E-GS	QPF-1848VG-GL	QPF-1848VG-GS
18" x 54"	QPF-1854E-GL	QPF-1854E-GS	QPF-1854VG-GL	QPF-1854VG-GS
18" x 60"	QPF-1860E-GL	QPF-1860E-GS	QPF-1860VG-GL	QPF-1860VG-GS
18" x 72"	QPF-1872E-GL	QPF-1872E-GS	QPF-1872VG-GL	QPF-1872VG-GS
21" x 24"	QPF-2124E-GL	QPF-2124E-GS	QPF-2124VG-GL	QPF-2124VG-GS
21" x 30"	QPF-2130E-GL	QPF-2130E-GS	QPF-2130VG-GL	QPF-2130VG-GS
21" x 36"	QPF-2136E-GL	QPF-2136E-GS	QPF-2136VG-GL	QPF-2136VG-GS
21" x 42"	QPF-2142E-GL	QPF-2142E-GS	QPF-2142VG-GL	QPF-2142VG-GS
21" x 48"	QPF-2148E-GL	QPF-2148E-GS	QPF-2148VG-GL	QPF-2148VG-GS
21" x 54"	QPF-2154E-GL	QPF-2154E-GS	QPF-2154VG-GL	QPF-2154VG-GS
21" x 60"	QPF-2160E-GL	QPF-2160E-GS	QPF-2160VG-GL	QPF-2160VG-GS
21" x 72"	QPF-2172E-GL	QPF-2172E-GS	QPF-2172VG-GL	QPF-2172VG-GS
24" x 24"	QPF-2424E-GL	QPF-2424E-GS	QPF-2424VG-GL	QPF-2424VG-GS
24" x 30"	QPF-2430E-GL	QPF-2430E-GS	QPF-2430VG-GL	QPF-2430VG-GS
24" x 36"	QPF-2436E-GL	QPF-2436E-GS	QPF-2436VG-GL	QPF-2436VG-GS
24" x 42"	QPF-2442E-GL	QPF-2442E-GS	QPF-2442VG-GL	QPF-2442VG-GS
24" x 48"	QPF-2448E-GL	QPF-2448E-GS	QPF-2448VG-GL	QPF-2448VG-GS
24" x 54"	QPF-2454E-GL	QPF-2454E-GS	QPF-2454VG-GL	QPF-2454VG-GS
24" x 60"	QPF-2460E-GL	QPF-2460E-GS	QPF-2460VG-GL	QPF-2460VG-GS
24" x 72"	QPF-2472E-GL	QPF-2472E-GS	QPF-2472VG-GL	QPF-2472VG-GS

**QuadPLUS® with Standard Wire Truss Frames and Blue Shelf Mats**

width x length in. mm	...w/VALU-MASTER® gray epoxy		...with Chrome finish	
	w/louvered mats model #	with solid mats model #	w/louvered mats model #	with solid mats model #
18" x 24"	QPF-1824V-BL	QPF-1824V-BS	QPF-1824C-BL	QPF-1824C-BS
18" x 30"	QPF-1830V-BL	QPF-1830V-BS	QPF-1830C-BL	QPF-1830C-BS
18" x 36"	QPF-1836V-BL	QPF-1836V-BS	QPF-1836C-BL	QPF-1836C-BS
18" x 42"	QPF-1842V-BL	QPF-1842V-BS	QPF-1842C-BL	QPF-1842C-BS
18" x 48"	QPF-1848V-BL	QPF-1848V-BS	QPF-1848C-BL	QPF-1848C-BS
18" x 54"	QPF-1854V-BL	QPF-1854V-BS	QPF-1854C-BL	QPF-1854C-BS
18" x 60"	QPF-1860V-BL	QPF-1860V-BS	QPF-1860C-BL	QPF-1860C-BS
18" x 72"	QPF-1872V-BL	QPF-1872V-BS	QPF-1872C-BL	QPF-1872C-BS
21" x 24"	QPF-2124V-BL	QPF-2124V-BS	QPF-2124C-BL	QPF-2124C-BS
21" x 30"	QPF-2130V-BL	QPF-2130V-BS	QPF-2130C-BL	QPF-2130C-BS
21" x 36"	QPF-2136V-BL	QPF-2136V-BS	QPF-2136C-BL	QPF-2136C-BS
21" x 42"	QPF-2142V-BL	QPF-2142V-BS	QPF-2142C-BL	QPF-2142C-BS
21" x 48"	QPF-2148V-BL	QPF-2148V-BS	QPF-2148C-BL	QPF-2148C-BS
21" x 54"	QPF-2154V-BL	QPF-2154V-BS	QPF-2154C-BL	QPF-2154C-BS
21" x 60"	QPF-2160V-BL	QPF-2160V-BS	QPF-2160C-BL	QPF-2160C-BS
21" x 72"	QPF-2172V-BL	QPF-2172V-BS	QPF-2172C-BL	QPF-2172C-BS
24" x 24"	QPF-2424V-BL	QPF-2424V-BS	QPF-2424C-BL	QPF-2424C-BS
24" x 30"	QPF-2430V-BL	QPF-2430V-BS	QPF-2430C-BL	QPF-2430C-BS
24" x 36"	QPF-2436V-BL	QPF-2436V-BS	QPF-2436C-BL	QPF-2436C-BS
24" x 42"	QPF-2442V-BL	QPF-2442V-BS	QPF-2442C-BL	QPF-2442C-BS
24" x 48"	QPF-2448V-BL	QPF-2448V-BS	QPF-2448C-BL	QPF-2448C-BS
24" x 54"	QPF-2454V-BL	QPF-2454V-BS	QPF-2454C-BL	QPF-2454C-BS
24" x 60"	QPF-2460V-BL	QPF-2460V-BS	QPF-2460C-BL	QPF-2460C-BS
24" x 72"	QPF-2472V-BL	QPF-2472V-BS	QPF-2472C-BL	QPF-2472C-BS



corner collar of standard wire truss frame

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Rev. 03/14

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## ***Submittal Sheet***

01/09/2023

### **ITEM# 94 - DUNNAGE RACK (2 EA REQ'D)**

Eagle Group PD4822-X

Dunnage Rack, polymer, 48"W x 22"D x 12"H, black polyethylene construction, 3000 lb. capacity, NSF (FLYER)



Profit from the Eagle Advantage®

## Specification Sheet

### Short Form Specifications

Eagle Polymer Dunnage Rack, model \_\_\_\_\_.  
Constructed of durable polyethylene. Weight capacity ranges from 2,000 to 3,500 pounds.

Eagle Aluminum Dunnage Rack, model \_\_\_\_\_.  
All aluminum welded construction with 1½" square tubular legs with bottom plastic caps.

Eagle Nesting Dunnage Rack, model \_\_\_\_\_.  
All aluminum welded construction. 2,700- to 3,200-lb. weight capacity. Racks are stackable.



*polymer dunnage rack*



*aluminum dunnage rack*



*nesting dunnage rack*

Item No.:	_____
Project No.:	_____
S.I.S. No.:	_____

## Polymer and Aluminum Dunnage Racks

### MODELS:

- |                                      |                                      |                                      |
|--------------------------------------|--------------------------------------|--------------------------------------|
| <input type="checkbox"/> PD3622      | <input type="checkbox"/> WDR243608-A | <input type="checkbox"/> NDR202412-A |
| <input type="checkbox"/> PD4822      | <input type="checkbox"/> WDR244808-A | <input type="checkbox"/> NDR203612-A |
| <input type="checkbox"/> PD6022      | <input type="checkbox"/> WDR246008-A | <input type="checkbox"/> NDR204812-A |
| <input type="checkbox"/> PD4836      | <input type="checkbox"/> NDR182412-A | <input type="checkbox"/> NDR242412-A |
| <input type="checkbox"/> WDR203608-A | <input type="checkbox"/> NDR183612-A | <input type="checkbox"/> NDR243612-A |
| <input type="checkbox"/> WDR204808-A | <input type="checkbox"/> NDR184812-A | <input type="checkbox"/> NDR244812-A |
| <input type="checkbox"/> WDR206008-A |                                      |                                      |

### Polymer Dunnage Racks

- Durable polyethylene construction prevents corrosion and rust.
- 2,000 to 3,500 lb. (907 to 1588 kg) weight capacity.
- No assembly required.
- 12" (305mm) height.

### Aluminum Dunnage Racks

- All aluminum construction.
- No assembly required.
- 1½" (38mm) square tubing with bottom plastic caps.
- Available in 8" and 12" (203 and 305mm) heights.

### Nesting Dunnage Racks

- All aluminum construction.
- 2,700 to 3,200 lb. (1134 to 1361 kg) weight capacity.
- Stackable, saving space when not in use.
- No assembly required.
- 12" (305mm) height.

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For custom configuration or fabrication needs, contact our SpecFAB® Division.

Phone: 302-653-3000 • Fax: 302-653-3091 • e-mail: specfab@eaglegrp.com

### Certifications / Approvals



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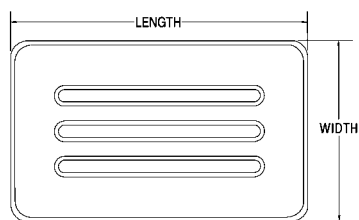
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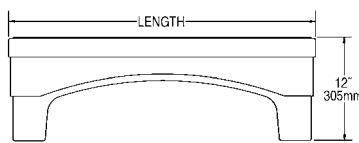
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 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

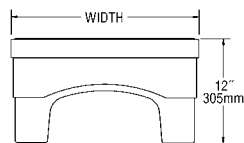
## Polymer and Aluminum Dunnage Racks



TOP VIEW



FRONT VIEW

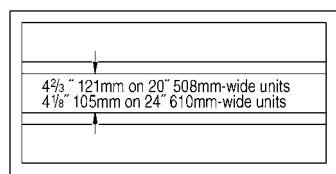


SIDE VIEW

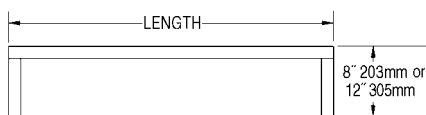
### Polymer Dunnage Racks

model #	width		x length		x height		weight		capacity		color
	in.	mm	in.	mm	in.	mm	lbs.	kg	lbs.	kg	
<b>PD3622</b>	22"	559	36"	914	12"	305	18	8.2	2000	907	black
<b>PD4822</b>	22"	559	48"	1219	12"	305	24	10.9	3000	1361	black
<b>PD6022</b>	22"	559	60"	1524	12"	305	28	12.7	3000	1361	black
<b>PD4836</b>	36"	914	48"	1219	12"	305	35	15.9	3500	1588	black

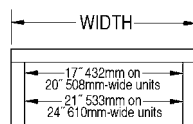
### Aluminum Dunnage Racks



TOP VIEW



FRONT VIEW

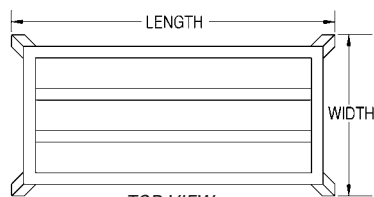


SIDE VIEW

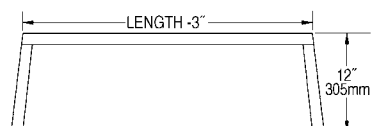
model #	width		x length		x height *		weight		weight capacity		number of legs	number of lats.
	in.	mm	in.	mm	in.	mm	lbs.	kg	lbs.	kg		
<b>WDR203608-A</b>	20"	508	36"	914	8"	203	10	4.5	2000	907	4	4
<b>WDR204808-A</b>	20"	508	48"	1219	8"	203	14	6.4	2000	907	4	4
<b>WDR206008-A</b>	20"	508	60"	1524	8"	203	18	8.2	1500	680	4	4
<b>WDR243608-A</b>	24"	610	36"	914	8"	203	12	5.4	2000	907	4	5
<b>WDR244808-A</b>	24"	610	48"	1219	8"	203	16	7.3	2000	907	4	5
<b>WDR246008-A</b>	24"	610	60"	1524	8"	203	20	9.0	1500	680	4	5

\* Models listed are 8" (203mm) high. To order models with 12" (305mm) height, replace "08" in model number with "12". Example: WDR203612-A.

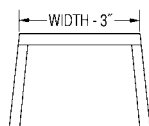
### Nesting Dunnage Racks



TOP VIEW



FRONT VIEW



SIDE VIEW

model #	width		x length		x height		weight		weight capacity	
	in.	mm	in.	mm	in.	mm	lbs.	kg	lbs.	kg
<b>NDR182412-A</b>	18"	457	24"	610	12"	305	8	3.6	3200	1452
<b>NDR183612-A</b>	18"	457	36"	914	12"	305	10	4.5	3200	1452
<b>NDR184812-A</b>	18"	457	48"	1219	12"	305	12	5.4	2700	1225
<b>NDR202412-A</b>	20"	508	24"	610	12"	305	8	3.6	3200	1452
<b>NDR203612-A</b>	20"	508	36"	914	12"	305	10	4.5	3200	1452
<b>NDR204812-A</b>	20"	508	48"	1219	12"	305	12	5.4	2700	1225
<b>NDR242412-A</b>	24"	610	24"	610	12"	305	9	4.1	3200	1452
<b>NDR243612-A</b>	24"	610	36"	914	12"	305	11	5.0	3200	1452
<b>NDR244812-A</b>	24"	610	48"	1219	12"	305	14	6.4	2700	1225

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## Submittal Sheet

01/09/2023

### ITEM# 95 - FREEZER SHELVING (1 LT REQ'D)

Eagle Group

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	12	2448VG-X	Shelf, wire, 48"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 800 lbs. capacity, Valu-Gard® green epoxy finish, NSF (FLYER)
Eagle Group	8	2460VG-X	Shelf, wire, 60"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 600 lbs. capacity, Valu-Gard® green epoxy finish, NSF (FLYER)
Eagle Group	8	2454VG	Shelf, wire, 54"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 600 lbs. capacity, Valu-Gard® green epoxy finish, NSF
Eagle Group	24	P74-VG-X	Post, stationary, 74"H, grooved in 1" increments, includes post cap & leveling bolt, Valu-Gard® green epoxy finish, NSF (FLYER)
Eagle Group	16	A200012	"S"Hook, joins individual wire shelf units end-to-end, back-to-back, or at right angles. (2) required per shelf connection.



Profit from the Eagle Advantage®

## Specification Sheet



clear plastic label holder

### Plastic Label Holders for Standard Shelving

Provides easy identification of shelf contents or section. Plastic Label Holders accommodate up to 1½" (38mm)-high labels. Available in gray, black or clear.

Plastic Label Holders for Reverse Mat Shelves also available—see spec sheet #EG01.03E.

label holder length		gray	black	clear	fits shelf length	
in.	mm	model #	model #	model #	in.	mm
3"	76	A204331	A206216	A208746	all lengths	
13"	330	A206196	A206217	A208747	18"	457
19"	483	A206197	A206218	A208749	24"	610
25"	635	A206198	A206219	A208750	30"	762
31"	787	A206199	A206220	A208751	36"	914
33"	838	A213096	A227763	A227764	36"	914
37"	940	A223747	A223748	A223749	42"	1067
43"	1092	A206200	A206221	A208752	48"	1219
45"	1143	A212494	A225208	A217621	48"	1219
55"	1397	A206201	A206222	A208753	60"	1524
67"	1702	A227842	A227841	A222144	72"	1829

### Rods & Tabs

Used to enclose rear or sides of shelving units to prevent contents from falling. Also used to partition shelving units by positioning rods interior to shelves. Each rod comes with four tabs.

chrome model #	stainless steel		height	
	model #	model #	in.	mm
R54-C	R54-S		54"	1372
R63-C	R63-S		63"	1600
R74-C	R74-S		74"	1880
R86-C	R86-S		86"	2184



rod with tab in place

### Joining Clamps

Use these, and two additional posts, to create various solid shelving add-on configurations. Two required per shelf.

model #: A203078



joining clamp

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Item No.: \_\_\_\_\_  
Project No.: \_\_\_\_\_  
S.I.S. No.: \_\_\_\_\_

## Wire and Solid Shelving Components and Accessories—Split Sleeves, Post Components, Miscellaneous

### MODELS:

- |                                     |   |  |
|-------------------------------------|---|--|
| <input type="checkbox"/> A2*        | <input type="checkbox"/> PLASTIC SPLIT SLEEVE | <input type="checkbox"/> LEVELING FOOT |
| <input type="checkbox"/> B201023    | <input type="checkbox"/> 4PEK                 | <input type="checkbox"/> POST CLAMP    |
| <input type="checkbox"/> R*-C       | <input type="checkbox"/> POST CAP             | <input type="checkbox"/> GLIDES        |
| <input type="checkbox"/> R*-S       | <input type="checkbox"/> COLLAR PLUG          | <input type="checkbox"/> FOOT PLATE*   |
| <input type="checkbox"/> S-HOOKS-SK |   |  |

\* See charts for complete model numbers.

### Plastic Split Sleeves

Four included with each shelf. Packed four per bag.

model #

PLASTIC SPLIT SLEEVE



plastic split sleeve

### Aluminum Split Sleeves

Used for conductive purposes. Set of four.

model #	description
A208909	with zinc rings
A208908	with s/s rings



aluminum split sleeves and ring

### Plastic Conductive Split Sleeves

Packed four per bag.

model #: A219236



plastic conductive split sleeves

### Security "S" Hook

Discourages separation of adjoined shelf units. Hardware included.

model #: S-HOOKS-SK



security "S" hook

### "S" Hook

Joins individual wire shelf units end-to-end, back-to-back, or at right angles. Two required per shelf connection.

model #: A200012



"S" hook



EG01.03D Rev. 04/18



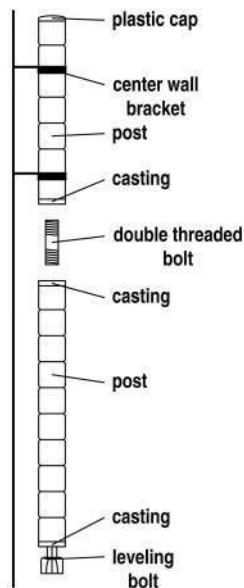
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Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

## Wire and Solid Shelving Split Sleeves, Post Components, Miscellaneous

### Post Extension Kit and Components

Screw posts together with double-threaded bolt and extra foot casting, includes components.



AS A KIT	
model #	item
<b>4PEK</b>	post extension kit

AS INDIVIDUAL PARTS	
model #	item
<b>A200868</b>	double-threaded bolt
<b>B201023</b>	wall bracket
<b>A207351</b>	casting

#### Please note:

DO NOT attempt to use any higher combinations than P54 and P86 maximum, 140" (3556mm) total. Any combinations higher than 86" (2184mm) must be attached to walls using wall bracket on post adjacent to wall. Place units only against wall, not in center of room.

### Post Clamp

Provides maximum strength when shelving units are connected by clamping posts together securely.

chrome model #	black model #
<b>POST CLAMP</b>	<b>A214169</b>



### Protective Glides

Fits under leveling foot to protect floors from abrasion.

model #: **GLIDES**



### Collar Plug

Fills shelf corner openings where posts have been eliminated by use of "S" hooks.

model #: **COLLAR PLUG**



### Post Cap

Fits post end openings at top of shelving unit.

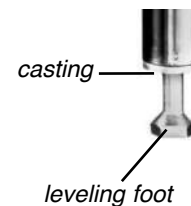
model #: **POST CAP**



### Leveling Foot

Use these to accommodate for uneven floors.

model #: **LEVELING FOOT**



### Casting

Stabilizes leveling foot.

model #: **A203568**

### Foot Plates

These allow unit to be bolted to the floor. Can be used without bolts when a wider foot is desired.

#### SQUARE FOOT PLATES

chrome model #	black epoxy model #	stainless steel model #
<b>A207199</b>	<b>A226104</b>	<b>A208627</b>



#### TRIANGULAR FOOT PLATES

chrome model #	black epoxy model #	stainless steel model #
<b>FOOT PLATE</b>	<b>FOOT PLATE-BL</b>	<b>FOOT PLATE-S</b>



#### "SPACE-SAVING" SQUARE FOOT PLATES

chrome model #	black epoxy model #	stainless steel model #
<b>A226093</b>	<b>A226105</b>	<b>A226096</b>



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## ***Submittal Sheet***

01/09/2023

### **ITEM# 96 - DUNNAGE RACK (2 EA REQ'D)**

Eagle Group PD4822-X

Dunnage Rack, polymer, 48"W x 22"D x 12"H, black polyethylene construction, 3000 lb. capacity, NSF (FLYER)

The spec sheet for this item can be viewed on item 94)





## Submittal Sheet

01/09/2023

### ITEM# 97 - DRY STORAGE SHELVING (1 LT REQ'D)

Eagle Group

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	32	2460C	Shelf, wire, 60"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 600 lbs. capacity, chrome-plated finish, NSF
Eagle Group	8	2448C-X	Shelf, wire, 48"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 800 lbs. capacity, chrome-plated finish, NSF (FLYER)
Eagle Group	40	CP74-C	Caster Post, 74"H, grooved in 1" increments, chrome finish, NSF
Eagle Group	20	CSS5-300-X	Stem Caster, swivel, 5" wheel diameter, 1-1/4" wheel face, 300 lb. capacity, resilient tread, donut bumper included, EAGLEbrite® zinc, NSF (FLYER)
Eagle Group	20	CSB5-300-X	Stem Caster with Brake, 5" wheel diameter, 1-1/4" wheel face, 300 lb. capacity, resilient tread, donut bumper included, EAGLEbrite® zinc, NSF (FLYER)



Profit from the Eagle Advantage®

## Specification Sheet

### Short Form Specifications

Eagle Stem Caster, model \_\_\_\_\_. For use with 1"-diameter posts. Resilient or polyurethane tread. Casters with zinc, stainless steel, and polymer boot available. For electronic handling, conductive casters available. Donut bumper included with all stem casters. Swivel casters have a temperature rating of -15°F (-26°C). Note: These stem casters cannot be used with Master Trak® Shelving.

Item No.:	_____
Project No.:	_____
S.I.S. No.:	_____

## Stem Casters

### MODELS:

- |                                   |                                   |                                    |                                  |
|-----------------------------------|-----------------------------------|------------------------------------|----------------------------------|
| <input type="checkbox"/> CSS4-125 | <input type="checkbox"/> CSB5P-*  | <input type="checkbox"/> CSPB5-300 | <input type="checkbox"/> A201008 |
| <input type="checkbox"/> CSS5*    | <input type="checkbox"/> CSR5P-*  | <input type="checkbox"/> CPSS5PS-* | <input type="checkbox"/> A201009 |
| <input type="checkbox"/> CSB5*    | <input type="checkbox"/> CSS5PS-* | <input type="checkbox"/> CPSB5PS-* | <input type="checkbox"/> A204795 |
| <input type="checkbox"/> CSR5*    | <input type="checkbox"/> CSB5PS-* | <input type="checkbox"/> A201706   | <input type="checkbox"/> A207562 |
| <input type="checkbox"/> CSS5P-*  | <input type="checkbox"/> CSR5PS-* | <input type="checkbox"/> A201007   | <input type="checkbox"/> A200019 |
|                                   |                                   |                                    | <input type="checkbox"/> A213261 |

\* See charts for complete model numbers.



swivel caster  
with resilient tread



(nickel-plated) caster  
with polyurethane tread



conductive caster

### Casters with Resilient Tread

type	EAGLEbrite® zinc capacity			stainless steel capacity			wheel diameter		wheel face		weight	
	model #	lbs.	kg	model #	lbs.	kg	in.	mm	in.	mm	lbs.	kg
swivel	CSS4-125	125	56.7	n/a			4"	102	1"	25	1.1	0.5
swivel	CSS5-125	125	56.7	n/a			5"	127	1"	25	2.0	0.9
swivel	CSS5-300	300	136.1	CSS5S-200	200	90.7	5"	127	1 1/4"	32	2.5	1.2
w/brake	CSB5-300	300	136.1	CSB5S-200	200	90.7	5"	127	1 1/4"	32	2.8	1.3
w/step-pedal brake	CSPB5-300	300	136.1	n/a			5"	127	1 1/4"	32	2.8	1.3
rigid ▼	CSR5-300	300	136.1	CSR5S-200	200	90.7	5"	127	1 1/4"	32	3.5	1.6

### Casters with Polyurethane Tread

type	nickel-plated model #	stainless steel capacity		wheel diameter		wheel face		weight		
		model #	lbs.	kg	in.	mm	in.	mm	lbs.	kg
swivel	CSS5P-300	CSS5PS-300	300	136.1	5"	127	1 1/4"	32	2.5	1.1
w/brake	CSB5P-300	CSB5PS-300	300	136.1	5"	127	1 1/4"	32	2.8	1.3
rigid ▼	CSR5P-300	CSR5PS-300	300	136.1	5"	127	1 1/4"	32	3.5	1.6

### Conductive Casters For electronic handling only.

type	EAGLEbrite® zinc capacity		wheel diameter		wheel face		weight		
	model #	lbs.	kg	in.	mm	in.	mm	lbs.	kg
swivel	CSS5-CC	200	90.7	5"	127	1 1/4"	32	2.5	1.1
w/brake	CSB5-CC	200	90.7	5"	127	1 1/4"	32	2.8	1.3
rigid ▼	CSR5-CC	200	90.7	5"	127	1 1/4"	32	3.5	1.6

▼ See back page for optional Channel Frames available for use with rigid casters.

### EAGLE GROUP

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Foodservice Division: Phone 800-441-8440

MHC Division: Phone 800-637-5100

For custom configuration or fabrication needs, contact our SpecFAB® Division.

Phone: 302-653-3000 • Fax: 302-653-2065 • e-mail: quotes@eaglegrp.com

### Certifications / Approvals



AutoQuotes



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Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

## Stem Casters



cart-washable  
caster

### Cart-Washable Casters

Features stainless steel boot, swivel stem, sealed precision bearings, and polyurethane wheel.

type	stainless steel model #	capacity		wheel diameter		wheel face		weight	
		lbs.	kg	in.	mm	in.	mm	lbs.	kg
swivel	<b>CSS5WPS-300</b>	300	136.1	5"	127	1 1/4"	32	2.0	0.9
brake	<b>CSB5WPS-300</b>	300	136.1	5"	127	1 1/4"	32	2.0	0.9

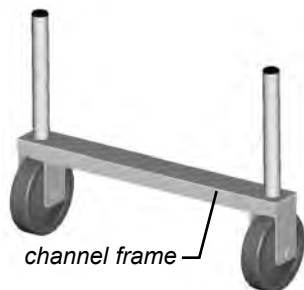


polymer caster

### Polymer Casters

With polyurethane tread.

type	model #	type of bearing	capacity		wheel diameter		wheel face		weight	
			lbs.	kg	in.	mm	in.	mm	lbs.	kg
swivel	<b>CPSS5-250</b>	delrin	250	113.4	5"	127	1 1/4"	32	2.0	0.9
brake	<b>CPSB5-250</b>	delrin	250	113.4	5"	127	1 1/4"	32	2.0	0.9



channel frame

### Channel Frames—for Rigid Stem Casters

Please note that shelf width must be known when ordering rigid stem casters in order to ship appropriate channel frame to lock rigid casters.

model #	shelf width		weight	
	in.	mm	lbs.	kg
<b>A201706</b>	14"	356	1.5	0.7
<b>A201007</b>	18"	457	2.0	0.9
<b>A201008</b>	21"	533	2.5	1.1
<b>A201009</b>	24"	610	2.8	1.3
<b>A204795</b>	30"	762	3.5	1.6
<b>A207562</b>	36"	914	4.0	1.8



donut bumper  
#A200019

### Donut Bumpers—for all Stem Casters

description	model #
3 1/2" (89mm) diameter	<b>A200019</b>
5" (127mm) diameter, with swivel center	<b>A213261</b>

### EAGLE GROUP

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MHC Division: Phone 800-637-5100

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## ***Submittal Sheet***

01/09/2023

### **ITEM# 98 - DUNNAGE RACK (1 EA REQ'D)**

Eagle Group PD4822-X

Dunnage Rack, polymer, 48"W x 22"D x 12"H, black polyethylene construction, 3000 lb. capacity, NSF (FLYER)

The spec sheet for this item can be viewed on item 94)



## ***Submittal Sheet***

01/09/2023

### **ITEM# 99 - CAN RACK (1 EA REQ'D)**

Eagle Group OCR-10-9A-X

Panco® Can Rack, full size, mobile design, self feeding gravity fed shelves, designed for (162) #10 or (216) #5 cans, all welded extruded aluminum construction, 4" swivel plate casters, NSF (FLYER)



Profit from the Eagle Advantage®

## Specification Sheet

### Short Form Specifications

Eagle Panco® Full Size Stationary Can Rack, model FCR-10-9A. All-welded aluminum construction, crossbraced front-to-back and side-to-side. Aluminum angle rack slides secured to frame at a slight angle to allow for gravity feed. Capacity: 162 #10 cans or 216 #5 cans.

Eagle Panco® Full Size Mobile Can Rack, model OCR-10-9A. All-welded aluminum construction, crossbraced front-to-back and side-to-side. Aluminum angle rack slides secured to frame at a slight angle to allow for gravity feed. Furnished with 4"-diameter casters. Capacity: 162 #10 cans or 216 #5 cans.



model #OCR-10-9A  
mobile can rack

### Options / Accessories

- Casters with locking brakes (for mobile unit only)\*
- Perimeter bumpers
- Vertical corner bumpers

\* Stationary unit cannot accept caster option.

### EAGLE GROUP

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MHC/Retail Display Divisions: Phone 800-637-5100

For custom configuration or fabrication needs, contact our SpecFAB® Division.

Phone: 302-653-3000 • Fax: 302-653-3091 • e-mail: specfab@eaglegrp.com

Item No.: \_\_\_\_\_  
Project No.: \_\_\_\_\_  
S.I.S. No.: \_\_\_\_\_

## Panco® Can Racks —Full Size

### MODELS:

- FCR-10-9A
- OCR-10-9A

### Design and Construction Features

- All-welded construction. Both racks are constructed of high-strength aluminum sections.
- Frame and supports: square aluminum tubing. Crossbraced front-to-back and side-to-side on top and bottom of unit.
- Rack slides made from aluminum angles, secured to frame at a slight angle for gravity feed.
- Casters on mobile unit: 4" (127mm)-diameter non-marking swivel plate casters with polymer tread, two with brake.
- Stationary unit comes with adjustable feet.
- Provides automatic stock rotation when loaded from rear.
- Shipped assembled.

### Certifications / Approvals



Spec sheets available for viewing, printing or downloading from our online literature library at [www.eaglegrp.com](http://www.eaglegrp.com)

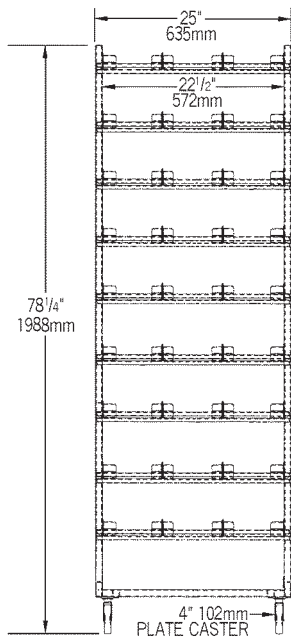
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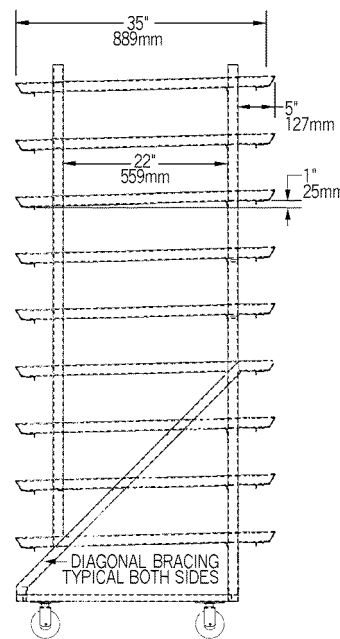
Profit from the Eagle Advantage®

Item No.: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 S.I.S. No.: \_\_\_\_\_

# Panco® Can Racks—Full Size



FRONT VIEW



SIDE VIEW

(#OCR-10-9A shown)

model #	description	overall dimensions						sliding space		can capacity		# of tiers high	weight	
		in.	mm	in.	mm	in.	mm	in.	mm	#10	#5		lbs.	kg
<b>FCR-10-9A</b>	full size, stationary	25"	635	35"	889	71"	1803	7 1/2"	191	162	216	9	63	28.6
<b>OCR-10-9A</b>	full size, mobile	25"	635	35"	889	78 1/4"	1988	7 1/2"	191	162	216	9	63	28.6

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## Submittal Sheet

01/09/2023

### ITEM# 100 - CHEMICAL SHELVING (1 LT REQ'D)

Eagle Group

#### ACCESSORIES

Mfr	Qty	Model	Spec
Eagle Group	8	2460VG	Shelf, wire, 60"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 600 lbs. capacity, Valu-Gard® green epoxy finish, NSF
Eagle Group	4	2472VG	Shelf, wire, 72"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 600 lbs. capacity, Valu-Gard® green epoxy finish, NSF
Eagle Group	4	2448VG	Shelf, wire, 48"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 800 lbs. capacity, Valu-Gard® green epoxy finish, NSF
Eagle Group	12	P74-VG	Post, stationary, 74"H, grooved in 1" increments, includes post cap & leveling bolt, Valu-Gard® green epoxy finish, NSF
Eagle Group	16	A200012	"S"Hook, joins individual wire shelf units end-to-end, back-to-back, or at right angles. (2) required per shelf connection.





## ***Submittal Sheet***

01/09/2023

### **ITEM# 200 - (1 EA REQ'D)**

#### **STAFF INSTALLATION**

Installation Services: Walk in Cooler/Freezers. Labor and materials to assemble walk in chambers furnished per quotation, hanging of coils, piping and insulation of refrigeration lines, setting of condenser units as required, crane service as required, pressure testing of refrigeration lines, charging of system, start up and adjustments. No electrical or control wiring included.

Price includes evaporator drains and heat tape as required.

Permanent roof sealing by others.



## ***Submittal Sheet***

01/09/2023

### **ITEM# 201 - (1 EA REQ'D)**

#### **STAFF INSTALLATION**

Installation services: Exhaust/Make up air systems

Labor and materials for hanging of exhaust hood.

Work platforms or safety rails if required by building or mechanical codes is not included. All electrical and plumbing connections by others.



## ***Submittal Sheet***

01/09/2023

### **ITEM# 202 - (1 EA REQ'D)**

#### **STAFF INSTALLATION**

Installation service: Based on items listed in this quotation only and does not include any addendums that may be added to project. Includes labor for receiving, inspection for freight damage, limited storage, delivery to job site, uncrating, removal of crating materials, assembly of components, set in place and make ready for mechanical hook up by electrical or plumbing contractors.

Pricing does not include any electrical, plumbing, building modification nor concrete work if applicable.



***Submittal Sheet***

01/09/2023

**ITEM# 203 - WALK IN FREIGHT (1 EA REQ'D)**

Custom



***Submittal Sheet***

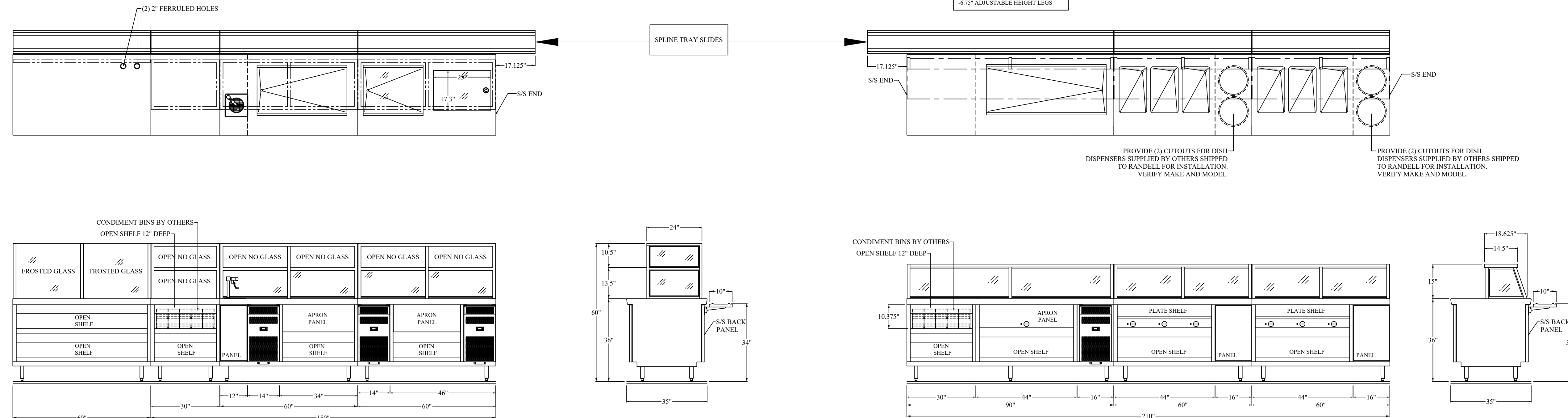
01/09/2023

**ITEM# 204 - EQUIPMENT FREIGHT (1 EA REQ'D)**

Custom

MODEL: 11360		MODEL: 11324		MODEL: 11348		MODEL: 11360	
ITEM # 7	UNIT # 10	ITEM # 1E	UNIT # 1	ITEM # 1D	UNIT # 2	ITEM # 1C	UNIT # 4
OPEN BASE UTILITY STAND -STAINLESS STEEL STORAGE SHELVES -16 GAUGE REINFORCED STAINLESS STEEL TOP -6.75" ADJUSTABLE HEIGHT LEGS 24" HIGH GLASS VERTICAL SHIELD STAINLESS STEEL INVERTED V TRAY SLIDE WITH FOLD DOWN BRACKETS		OPEN BASE UTILITY STAND -STAINLESS STEEL STORAGE SHELVES -16 GAUGE REINFORCED STAINLESS STEEL TOP -6.75" ADJUSTABLE HEIGHT LEGS DOUBLE TIER GLASS OVERSHELF -SAFETY GLASS TOPS -SAFETY GLASS SNEEZE GUARDS AND ENDS STAINLESS STEEL INVERTED V TRAY SLIDE WITH FOLD DOWN BRACKETS		OPEN BASE UTILITY STAND -STAINLESS STEEL STORAGE SHELVES -BUILT IN RCP-3 COLD PAN -ACCOMMODATES (18) 1/6 SIZE PANS -PANS PROVIDED BY OTHERS -(7) ADAPTER BARS PROVIDED -1/4 HP SELF CONTAINED R290 REFRIGERATION SYSTEM -SLIDE BACK COVER PROVIDED. OPTIONAL COVERS AVAILABLE. -1" DIAMETER PVC DRAIN WITH BALL VALVE LOCATED BEHIND LOUVER -115V/60Hz/1Ph/3.5 AMPS -HARDWIRE CONNECTION -6.75" ADJUSTABLE HEIGHT LEGS DOUBLE TIER GLASS OVERSHELF -SAFETY GLASS TOPS -SAFETY GLASS SNEEZE GUARDS AND ENDS STAINLESS STEEL INVERTED V TRAY SLIDE WITH FOLD DOWN BRACKETS		OPEN BASE UTILITY STAND -STAINLESS STEEL STORAGE SHELF -BUILT IN RCP-2 COLD PAN -ACCOMMODATES (24) 1/6 SIZE PANS -PANS PROVIDED BY OTHERS -(9) ADAPTER BARS PROVIDED -1/4 HP SELF CONTAINED R290 REFRIGERATION SYSTEM -SLIDE BACK COVER PROVIDED. OPTIONAL COVERS AVAILABLE. -1" DIAMETER PVC DRAIN WITH BALL VALVE LOCATED BEHIND LOUVER -115V/60Hz/1Ph/3.5 AMPS -HARDWIRE CONNECTION -6.75" ADJUSTABLE HEIGHT LEGS DOUBLE TIER GLASS OVERSHELF -SAFETY GLASS TOPS -SAFETY GLASS SNEEZE GUARDS AND ENDS STAINLESS STEEL INVERTED V TRAY SLIDE WITH FOLD DOWN BRACKETS	
MODEL: 19324		MODEL: 19324		MODEL: RFT-2		MODEL: RFT-2	
ITEM # 1D	UNIT # 2	ITEM # 1C	UNIT # 5	ITEM # 1D	UNIT # 3	ITEM # 1C	UNIT # 5
TOP EXTENSION WITH REMOVABLE FRONT PANEL -16 GAUGE REINFORCED STAINLESS STEEL TOP -6.75" ADJUSTABLE HEIGHT LEGS MODEL: 9530		BUILT-IN SELF-CONTAINED MECHANICALLY COOLED RECESSED FRONT TOP -ACCOMMODATES (2) FULL SIZE SHEET PANS 1" DRAIN PROVIDED -1/4 HP SELF CONTAINED R290 REFRIGERATION SYSTEM -115V/60Hz/3.5 AMPS -HARDWIRE CONNECTION		COUNTER TOP WATER STATION WITH GLASS FILLER AND DRAIN GRATE -5/8" DRAIN CONNECTION -INSTALLED WITH THREADED STUDS FOR COUNTER TOP INSTALLATION		COUNTER TOP WATER STATION WITH GLASS FILLER AND DRAIN GRATE -5/8" DRAIN CONNECTION -INSTALLED WITH THREADED STUDS FOR COUNTER TOP INSTALLATION	

MODEL: 31348		MODEL: 31348		MODEL: 31348	
ITEM # 1B	UNIT # 6	ITEM # 1A	UNIT # 8	ITEM # 1A	UNIT # 9
STAINLESS STEEL HOT FOOD TABLE -ACCOMMODATES (3) FULL SIZE PANS -PANS PROVIDED BY OTHERS -8" WIDE PLATE SHELF -OPEN STORAGE BASE -INDIVIDUAL THERMOSTATIC CONTROLS AND INDICATOR LIGHTS FOR FOOD WELLS -12" DIAMETER COPPER DRAIN WITH MANIFOLD TO BALL VALVE AT LEFT REAR OF UNIT. -208V/60Hz/1Ph/15.9 AMPS ALTERNATE VOLTAGES AVAILABLE -HARDWIRE CONNECTION AT REAR -6.75" ADJUSTABLE HEIGHT LEGS -OPTIONAL FILL FAUCET AVAILABLE		STAINLESS STEEL HOT FOOD TABLE -ACCOMMODATES (3) FULL SIZE PANS -PANS PROVIDED BY OTHERS -8" WIDE PLATE SHELF -OPEN STORAGE BASE -INDIVIDUAL THERMOSTATIC CONTROLS AND INDICATOR LIGHTS FOR FOOD WELLS -12" DIAMETER COPPER DRAIN WITH MANIFOLD TO BALL VALVE AT LEFT REAR OF UNIT. -208V/60Hz/1Ph/15.9 AMPS ALTERNATE VOLTAGES AVAILABLE -HARDWIRE CONNECTION AT REAR -6.75" ADJUSTABLE HEIGHT LEGS -OPTIONAL FILL FAUCET AVAILABLE		STAINLESS STEEL HOT FOOD TABLE -ACCOMMODATES (3) FULL SIZE PANS -PANS PROVIDED BY OTHERS -8" WIDE PLATE SHELF -OPEN STORAGE BASE -INDIVIDUAL THERMOSTATIC CONTROLS AND INDICATOR LIGHTS FOR FOOD WELLS -12" DIAMETER COPPER DRAIN WITH MANIFOLD TO BALL VALVE AT LEFT REAR OF UNIT. -208V/60Hz/1Ph/15.9 AMPS ALTERNATE VOLTAGES AVAILABLE -HARDWIRE CONNECTION AT REAR -6.75" ADJUSTABLE HEIGHT LEGS -OPTIONAL FILL FAUCET AVAILABLE	
MODEL: 19324		MODEL: 19324		MODEL: 19324	
ITEM # 1B	UNIT # 6	ITEM # 1A	UNIT # 8	ITEM # 1A	UNIT # 9
TOP EXTENSION WITH REMOVABLE FRONT PANEL -16 GAUGE REINFORCED STAINLESS STEEL TOP -6.75" ADJUSTABLE HEIGHT LEGS COUNTER PROTECTOR WITH GLASS FRONT, ENDS AND GLASS OR S/S TOP STAINLESS STEEL INVERTED V TRAY SLIDE WITH FOLD DOWN BRACKETS		TOP EXTENSION WITH REMOVABLE FRONT PANEL -16 GAUGE REINFORCED STAINLESS STEEL TOP -6.75" ADJUSTABLE HEIGHT LEGS COUNTER PROTECTOR WITH GLASS FRONT, ENDS AND GLASS OR S/S TOP STAINLESS STEEL INVERTED V TRAY SLIDE WITH FOLD DOWN BRACKETS		TOP EXTENSION WITH REMOVABLE FRONT PANEL -16 GAUGE REINFORCED STAINLESS STEEL TOP -6.75" ADJUSTABLE HEIGHT LEGS COUNTER PROTECTOR WITH GLASS FRONT, ENDS AND GLASS OR S/S TOP STAINLESS STEEL INVERTED V TRAY SLIDE WITH FOLD DOWN BRACKETS	
MODEL: RCHB-4		MODEL: RCHB-4		MODEL: RCHB-4	
ITEM # 1B	UNIT # 7	ITEM # 1B	UNIT # 6	ITEM # 1B	UNIT # 6
BUILT-IN SELF-CONTAINED MECHANICALLY COOLED COLD PAN/HOT FOOD WELL -OPEN WATER BATH TANK -ACCOMMODATES (4) 12" X 20" PANS -PANS PROVIDED BY OTHERS -ALL ADAPTER BARS PROVIDED 1" DRAIN WITH BALL VALVE ROCKER SWITCH AND THERMOSTATIC CONTROLS FOR HOT FUNCTION MOUNTED IN FRONT CONTROL PANEL -1/4 HP SELF CONTAINED R290 REFRIGERATION SYSTEM -COLD PAN: 115V/60Hz/1Ph/3.5 AMPS 9" NEMA 5-15 CORD AND PLUG -HOT WELLS: 208V/60Hz/1Ph/15.9 AMPS HARDWIRE CONNECTION		BUILT-IN SELF-CONTAINED MECHANICALLY COOLED COLD PAN/HOT FOOD WELL -OPEN WATER BATH TANK -ACCOMMODATES (4) 12" X 20" PANS -PANS PROVIDED BY OTHERS -ALL ADAPTER BARS PROVIDED 1" DRAIN WITH BALL VALVE ROCKER SWITCH AND THERMOSTATIC CONTROLS FOR HOT FUNCTION MOUNTED IN FRONT CONTROL PANEL -1/4 HP SELF CONTAINED R290 REFRIGERATION SYSTEM -COLD PAN: 115V/60Hz/1Ph/3.5 AMPS 9" NEMA 5-15 CORD AND PLUG -HOT WELLS: 208V/60Hz/1Ph/15.9 AMPS HARDWIRE CONNECTION		BUILT-IN SELF-CONTAINED MECHANICALLY COOLED COLD PAN/HOT FOOD WELL -OPEN WATER BATH TANK -ACCOMMODATES (4) 12" X 20" PANS -PANS PROVIDED BY OTHERS -ALL ADAPTER BARS PROVIDED 1" DRAIN WITH BALL VALVE ROCKER SWITCH AND THERMOSTATIC CONTROLS FOR HOT FUNCTION MOUNTED IN FRONT CONTROL PANEL -1/4 HP SELF CONTAINED R290 REFRIGERATION SYSTEM -COLD PAN: 115V/60Hz/1Ph/3.5 AMPS 9" NEMA 5-15 CORD AND PLUG -HOT WELLS: 208V/60Hz/1Ph/15.9 AMPS HARDWIRE CONNECTION	



**RANDELL REFRIGERATED CUSTOM DOOR SIZES AND REFRIGERATED BASE OPENING SIZES.**  
 RANDELL WILL NOT PROVIDE CUSTOM SIZE DOORS FOR REFRIGERATED BASES.

LOW PROFILE REFRIGERATED DOORS			FULL HEIGHT REFRIGERATED DOORS																															
<b>INTERIOR BASE DIMENSIONS</b> <table border="1"> <tr><th>DOOR SIZE</th><th>A</th><th>B</th></tr> <tr><td>19"</td><td>13.125"</td><td>13.125"</td></tr> <tr><td>27"</td><td>13.125"</td><td>22.125"</td></tr> </table>			DOOR SIZE	A	B	19"	13.125"	13.125"	27"	13.125"	22.125"	<b>INTERIOR BASE DIMENSIONS</b> <table border="1"> <tr><th>DOOR SIZE</th><th>A</th><th>B</th><th>C</th></tr> <tr><td>18"</td><td>20.125"</td><td>13.125"</td><td>10"</td></tr> <tr><td>21"</td><td>20.125"</td><td>16.125"</td><td>10"</td></tr> <tr><td>24"</td><td>20.125"</td><td>19.125"</td><td>10"</td></tr> <tr><td>27"</td><td>20.125"</td><td>22.125"</td><td>10"</td></tr> </table>			DOOR SIZE	A	B	C	18"	20.125"	13.125"	10"	21"	20.125"	16.125"	10"	24"	20.125"	19.125"	10"	27"	20.125"	22.125"	10"
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**RANDELL CUSTOM CONSTRUCTION**

**TOP**  
 -16 GAUGE STAINLESS STEEL WITH 12 GAUGE SPLINE BARS AT ENDS FOR FIELD BOLTING UNITS PRODUCING A HAIRLINE SEAM  
**UNIT BODY**  
 -STAINLESS STEEL ALL WELDED FRAME CONSTRUCTION  
 -ALL CORNERS TO BE WELDED AND POLISHED  
 -BODY PANELS TO BE STAINLESS STEEL  
**SHELVES**  
 -STAINLESS STEEL CONSTRUCTION WITH GALVANIZED BRACING  
**LEGS**  
 -6.75" LOAD HEIGHT WITH ADJUSTABLE BULLET FOOT  
**REFRIGERATED BASE INTERIOR**  
 -TO BE ABS THERMOPLASTIC AT ENDS ONLY. STAINLESS STEEL INTERIOR LINER TO BE COVED CORNER TO FORM BOTTOM, BACK, AND TOP  
 -INTERIOR DOOR LINER TO BE ABS WITH INTEGRAL GASKET RETAINER FOR EASY CLEANING. DOORS ARE MOUNTED ON CONCEALED HINGES.

**REFRIGERATED COLD PANS**  
 -WRAPPED COLD WALL CONSTRUCTION WITH FOAMED URETHANE INSULATION  
 -R290 REFRIGERATION SYSTEM WITH PRECISE TEMPERATURE ELECTRONIC CONTROL  
 -1" DRAIN WITH VALVE  
 -PANS TO BE RECESSED IN COLD PAN  
**HOT FOOD WELLS**  
 -12" X 20" STAMPED FOOD WELLS WITH DRAINS  
 -ELECTRIC HEATING ELEMENT  
 -THERMOSTAT CONTROL AND INDICATOR LIGHT FOR EACH WELL  
**REMOTE REFRIGERATION**  
 -REMOTE BASES PROVIDED WITH EXPANSION VALVE, THERMOSTAT, AND SOLENOID VALVE  
 -COLD PANS HAVE THEIR OWN EXPANSION VALVE, THERMOSTAT, AND SOLENOID VALVE FOR EASY ADJUSTMENT TO BALANCE THE SYSTEM  
**ELECTRICAL**  
 -ALL FIELD WIRE J-BOXES ARE ACCESSIBLE FROM THE FRONT AND CAN BE CONNECTED WITHOUT AFFECTING THE WIRING OR THE EQUIPMENT  
 -ALL EQUIPMENT LINE UPS WILL HAVE HARDWIRE CONNECTIONS

**CUSTOMER INFORMATION**  
 • RANDELL BUILD TOLERANCE = ±10% OVERALL MEASUREMENT  
 • ALL 1-20V, 1-6A & 20A CUSTOMER GENERAL USE ELECTRICAL  
 • TO AVOID LATE SHIPMENT, DEALER SUPPLIED BUYS MUST BE MARKED WITH JOB NAME AND MUST BE RECEIVED BY RANDELL WILL NOT INSTALL UNLISTED COMPONENTS.

THIS DRAWING IS THE PROPERTY OF RANDELL MANUFACTURING. THE PRIMARY INFORMATION OF RANDELL MANUFACTURING AND NOT THE PROPERTY OF THE CUSTOMER. INFORMATION CONTAINED HEREIN IS UNCLASSIFIED AND NOT PATENTED DESIGNS. THESE DRAWINGS ARE TO BE USED FOR PUBLIC RECORD ONLY AND ARE NOT TO BE REPRODUCED OR FILED IN ANY PUBLIC RECORD UNLESS REQUIRED BY LAW.

UNIFIED BRANDS  
**randell**  
 525 South Coldwater Road  
 Weidman, Michigan 48893-9683  
 Phone 1-800-621-8560  
 Fax 1-800-634-5369

**CTR. FOR FORENSIC PSYCHIATRY**  
**STAFFORD SMITH**  
**PREMIER MARKETING**

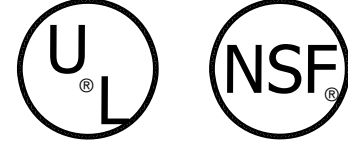
**JOB NAME**  
**DEALER**  
**CONSULTANT**  
**SALES REP**

**QUOTE #**  
**ORDER #**  
**REF ORDER #**  
**SHEET**

01/14/2022  
 REVISIONS  
 DATE DESCRIPTION  
 03/27/2023 REVISION  
 03/27/2023 REVISION

2140172  
 SCALE 1/2" = 1'  
 1 OF 1

**WALK - IN SPECIFICATIONS**



Combo - Meat Clr/Prod Clr/Frz  
**OVERALL SIZE: 29'-8" X 14'-5 1/2" X 8'-6 1/4" (INDOOR)**

**PANELS**  
 FOAMED IN PLACE URETHANE FOAM 4"

**EXTERIOR FINISH**  
 WALL: GALVALUME - EMBOSSED 26 GA EXCEPT AS NOTED  
 TOP: GALVALUME - EMBOSSED 26 GA

**INTERIOR FINISH**  
 WALL: GALVALUME - EMBOSSED WHITE 26GA.  
 TOP: GALVALUME - EMBOSSED WHITE 26GA.

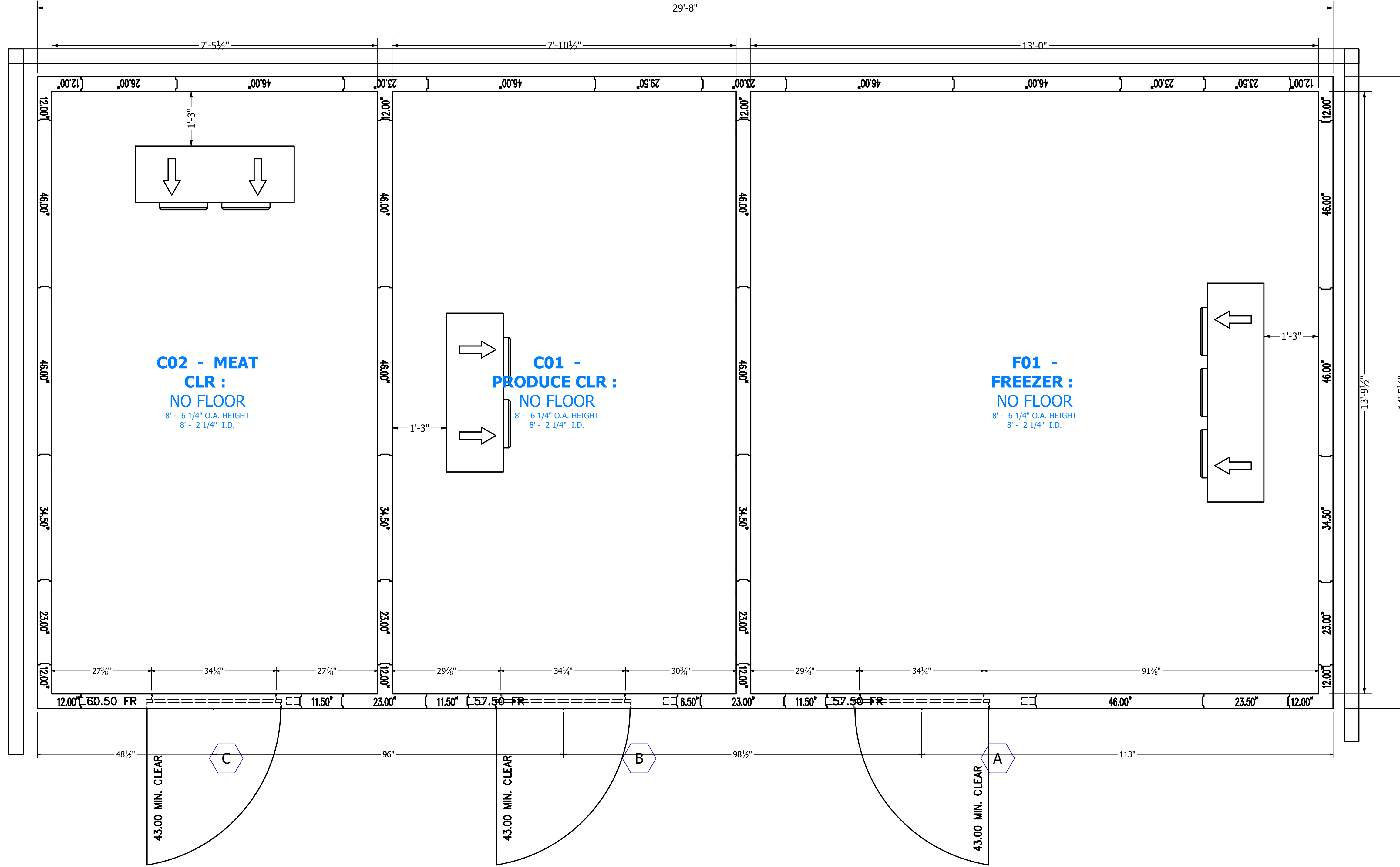
**FLOOR TYPE**  
 F01 FREEZER : SCREED, VINYL 4" X 4" HIGH  
 C01 PRODUCE CLR : SCREED, VINYL 4" X 4" HIGH  
 C02 MEAT CLR : SCREED, VINYL 4" X 4" HIGH

**WALK-IN ACCESSORIES**  
 (7) LIGHT - KASON 1810JUV LED 48IN 120/230V 50/60HZ (DIODE STRIPS)

**REFRIGERATION**  
 F01 FREEZER :  
 KPC299L0P-2EP, R404A, VOLTS: 208-230-60-1,BTU:11468  
 KEL36-121-2EC-PR-4 VOLTS: 208-230-60-1,BTU:11971  
 TEMP: WALK-IN -10,AMBIENT TEMP: 90

C01 PRODUCE CLR :  
 KPC69MZ0P-2EP, R404A, VOLTS: 208-230-60-1,BTU:9110  
 KAM26-094-1EC-PR-4 VOLTS: 115-60-1,BTU:9547  
 TEMP: WALK-IN 35,AMBIENT TEMP: 90

C02 MEAT CLR :  
 KPC69M0P-2EP, R404A, VOLTS: 208-230-60-1,BTU:6932  
 KAM26-073-1EC-PR-4 VOLTS: 115-60-1,BTU:7337  
 TEMP: WALK-IN 35,AMBIENT TEMP: 90



WALLS LAYOUT

**! ATTENTION**

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DATE: \_\_\_\_\_ BY: \_\_\_\_\_

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  - Condensing Units are UL1995.

DRAWING #: A210176R2  
 UNIT #: 001  
 ORDER #:



CTR FOR FORENSIC PSYCHIATRY - COMBO  
 SALINE, MI 48176 USA

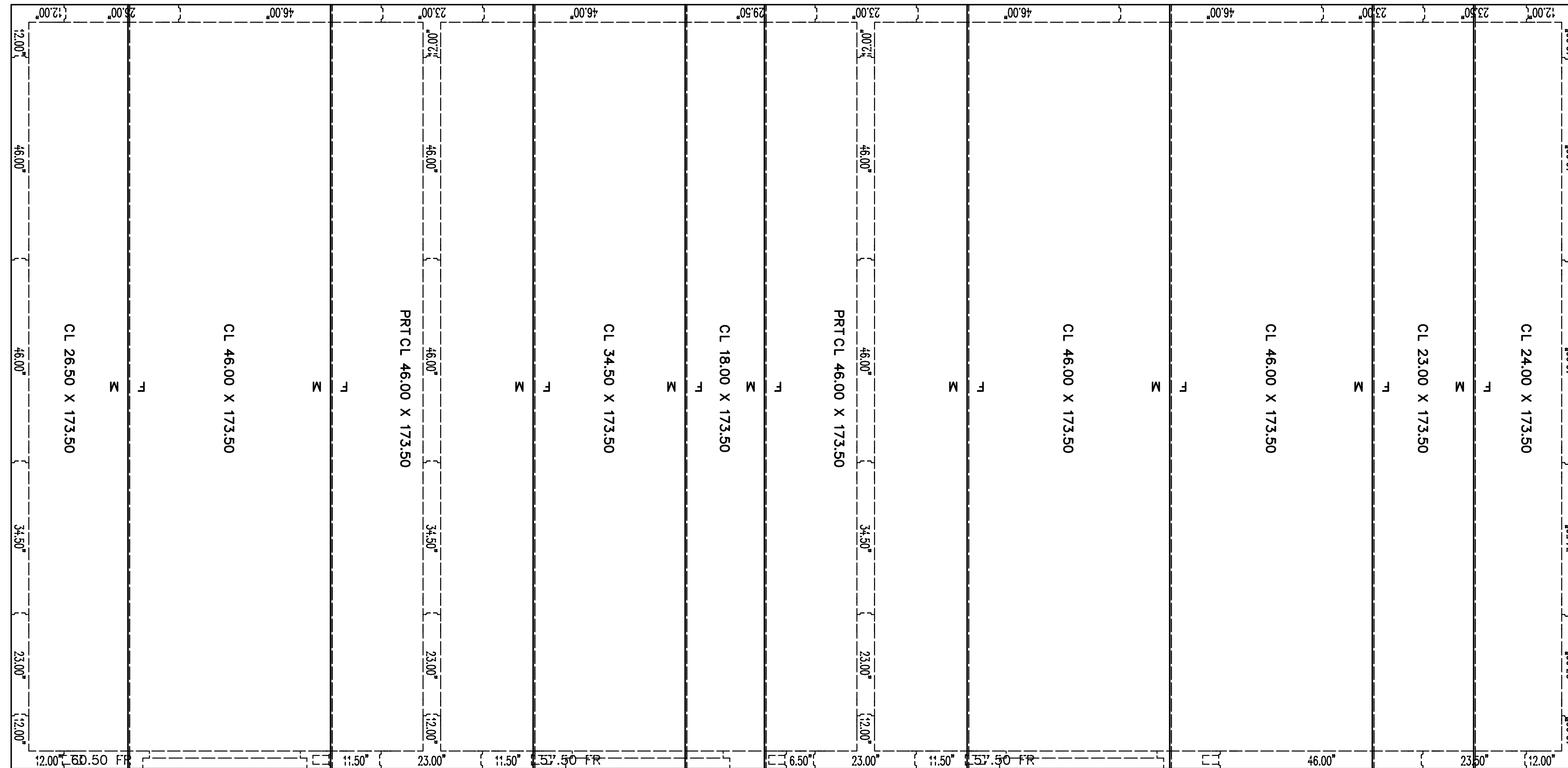
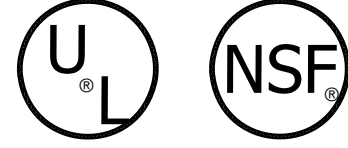
STAFFORD SMITH INC

DATE	QUOTE REVISION	CHECK BY	DATE
01/31/2022 <td>KAD <td></td> <td></td> </td>	KAD <td></td> <td></td>		

DRAWN BY: KAD  
 SHEET #  
 AD-1 of 4



**WALK - IN SPECIFICATIONS**



CEILING LAYOUT

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DATE: \_\_\_\_\_ BY: \_\_\_\_\_

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DRAWING #: A210176R2  
UNIT #: 001  
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CTR FOR FORENSIC PSYCHIATRY - COMBO  
SALINE, MI 48176 USA

STAFFORD SMITH INC

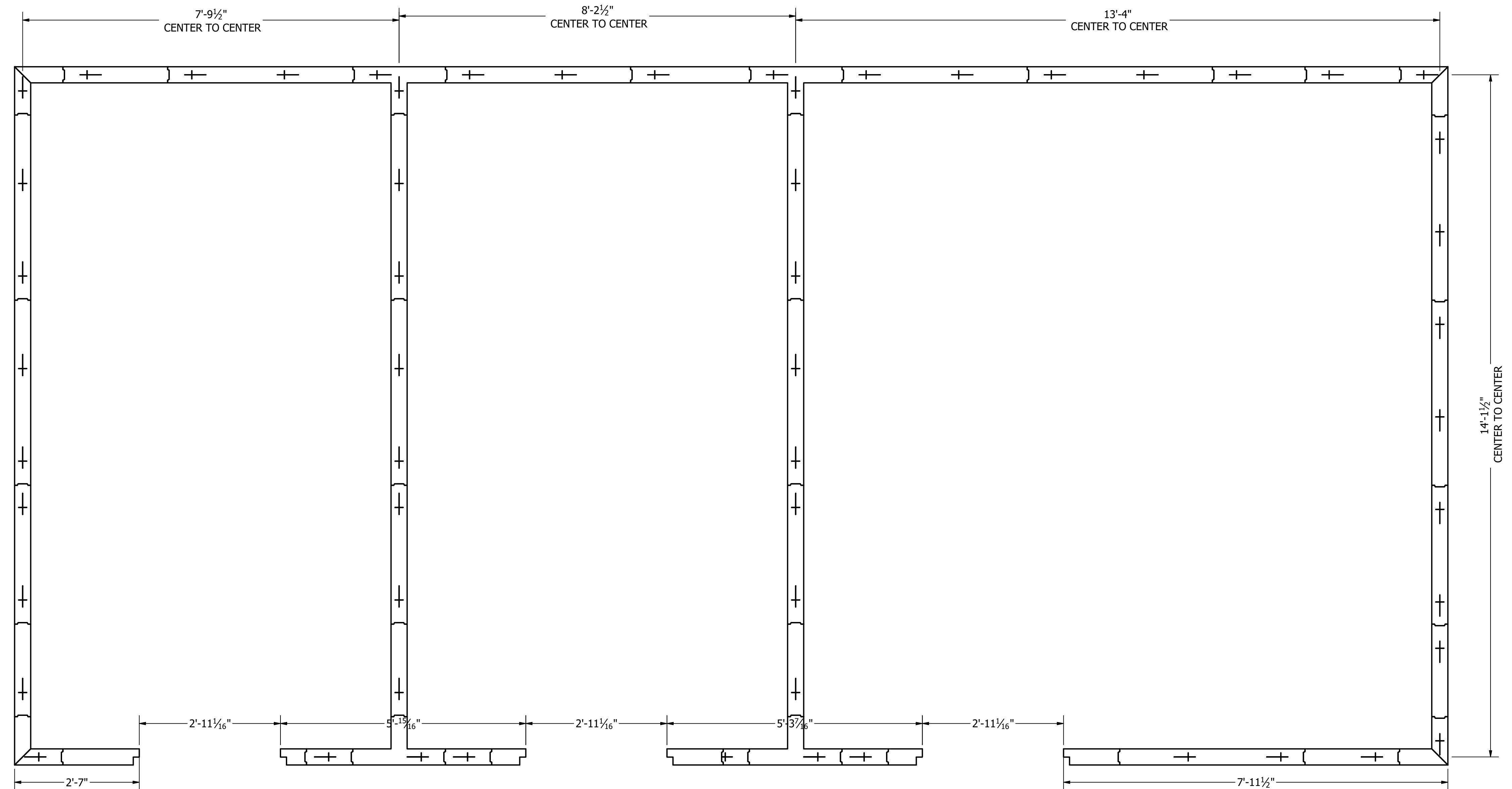
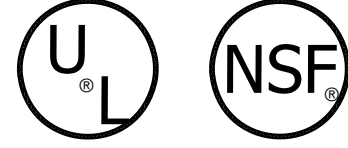
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DRAWN BY: KAD  
DATE: 01/31/2022

SHEET #  
AD-2 of 4



**WALK - IN SPECIFICATIONS**



SCREEDS LAYOUT

DRAWING #: A210176R2  
UNIT #: 001  
ORDER #:



CTR FOR FORENSIC PSYCHIATRY -  
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SALINE, MI 48176 USA

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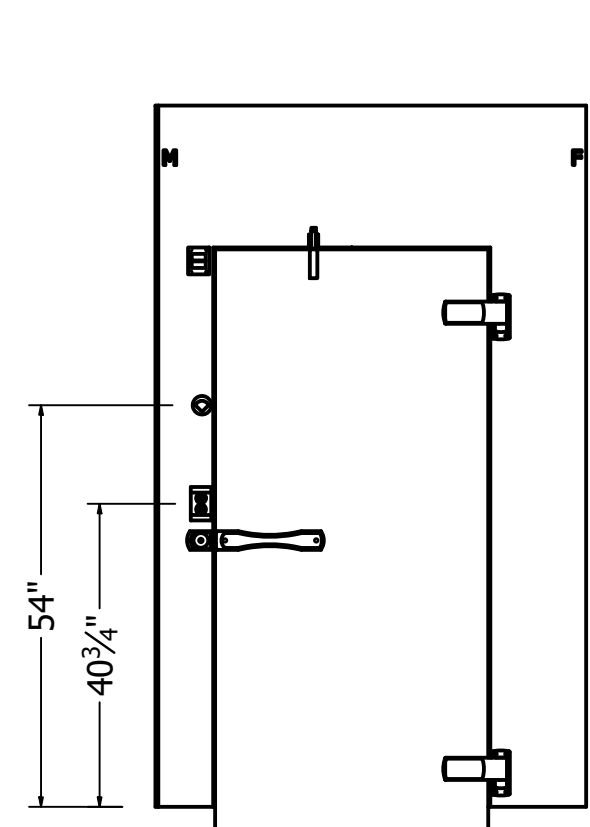
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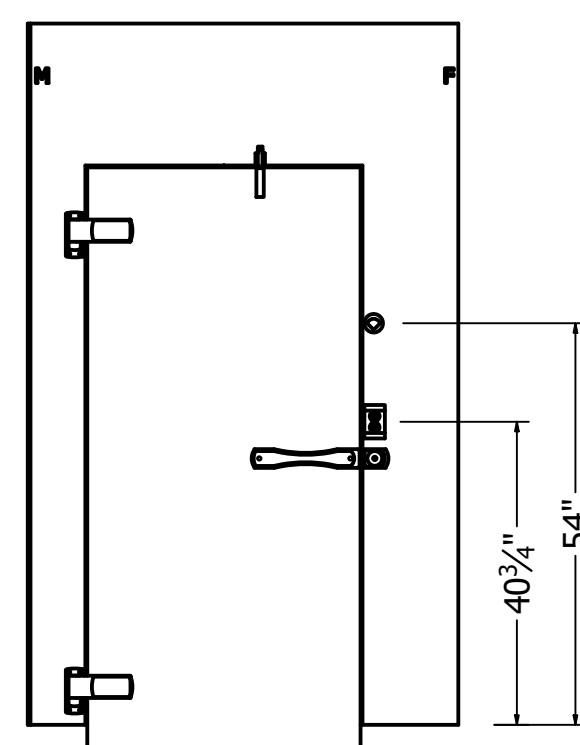


OFFSET -2.75  
DR 34.00" x 78.00"  
FR 57.50" x 94.25"  
DW-1

FRAME:  
RECESSED 0" WITH 0" LEVELING SAND AND 0" TILE AND GROUT  
EXT: GALVALUME - EMBOSSED 26 GA  
INT: GALVALUME - EMBOSSED WHITE 26GA.

PLUG:  
EXT: GALVALUME - EMBOSSED 26 GA  
INT: GALVALUME - EMBOSSED WHITE 26GA.

HARDWARE AND ACCESSORIES:  
(1) 115/60/1 ELECTRICAL  
(1) DOOR CLOSER - KASON 1094 BRUSHED CHROME (STD)  
(1) HANDLE - KASON 28 WITH LOCKING ASSEMBLY (STD)  
(1) HEATER WIRE, 5 WATT / FT  
(2) HINGE - KASON 1346 BRUSHED CHROME ADJUSTABLE / SPRING ASSISTED (STD)  
(1) LIGHT CENTERED OVER DOOR OPENING  
(1) LIGHT FIXTURE - KASON 1803 LED W/BULB, GLOBE AND NIGHTLIGHT 120V (STD)  
(1) SWITCH - PILOT LIGHT INCLUDED 120V UL (STD)  
(1) THERMOMETER - 2 INCH DIAL W/6' LEAD (STD)  
(3) THRESHOLD, STAINLESS STEEL 14 GA  
(1) VENT - PRESSURE RELIEF, HEATED KASON 1825 (STD)

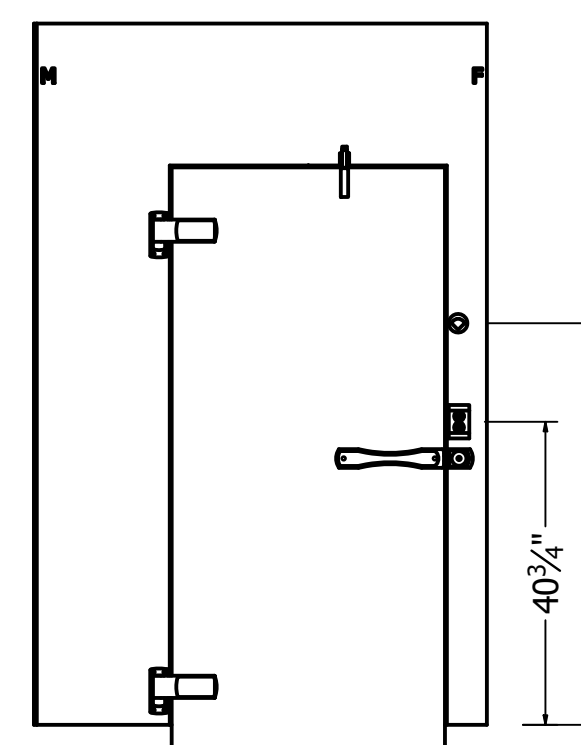


OFFSET -2.75  
DR 34.00" x 78.00"  
FR 57.50" x 94.25"  
DW-2

FRAME:  
RECESSED 0" WITH 0" LEVELING SAND AND 0" TILE AND GROUT  
EXT: GALVALUME - EMBOSSED 26 GA  
INT: GALVALUME - EMBOSSED WHITE 26GA.

PLUG:  
EXT: GALVALUME - EMBOSSED 26 GA  
INT: GALVALUME - EMBOSSED WHITE 26GA.

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(1) THERMOMETER - 2 INCH DIAL W/6' LEAD (STD)



OFFSET 6.25  
DR 34.00" x 78.00"  
FR 60.50" x 94.25"  
DW-3

FRAME:  
RECESSED 0" WITH 0" LEVELING SAND AND 0" TILE AND GROUT  
EXT: GALVALUME - EMBOSSED 26 GA  
INT: GALVALUME - EMBOSSED WHITE 26GA.

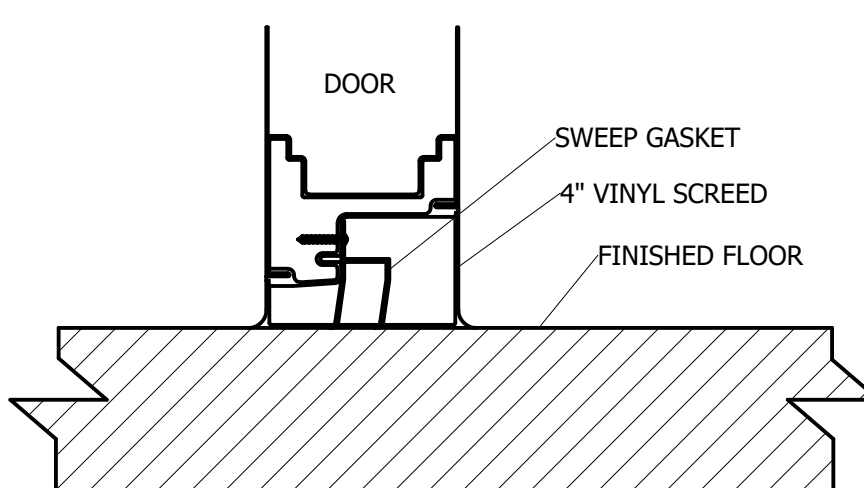
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(1) DOOR CLOSER - KASON 1094 BRUSHED CHROME (STD)  
(1) HANDLE - KASON 28 WITH LOCKING ASSEMBLY (STD)  
(2) HINGE - KASON 1346 BRUSHED CHROME ADJUSTABLE / SPRING ASSISTED (STD)  
(1) LIGHT CENTERED OVER DOOR OPENING  
(1) LIGHT FIXTURE - KASON 1803 LED W/BULB, GLOBE AND NIGHTLIGHT 120V (STD)  
(1) SWITCH - PILOT LIGHT INCLUDED 120V UL (STD)  
(1) THERMOMETER - 2 INCH DIAL W/6' LEAD (STD)

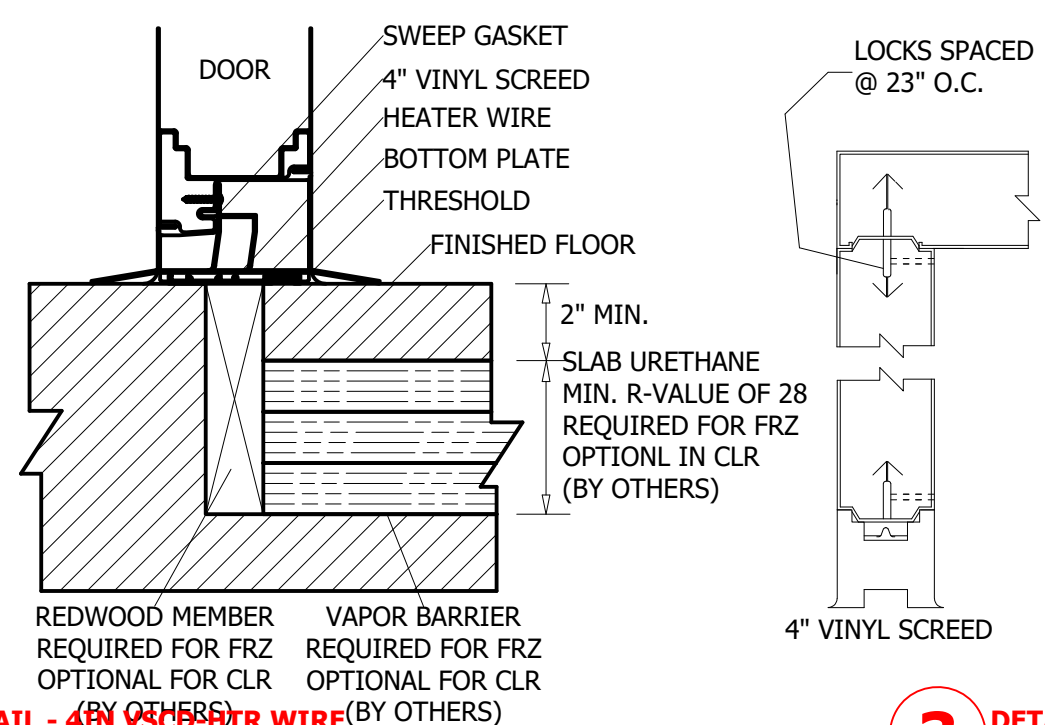
DOOR ELECTRICAL INFORMATION				
DESCRIPTION	QTY	VOLT	AMP	AMP LOAD
HEATED AIR VENT	1	115	0.04	0.04
HEATER WIRE	1	115	0.8	0.8
LED LIGHT	1	115	0.1	0.1
115 VOLT, SINGLE PHASE, 60 Hz, TOTAL DOOR AMPS:				0.94

DOOR ELECTRICAL INFORMATION				
DESCRIPTION	QTY	VOLT	AMP	AMP LOAD
LED LIGHT	1	115	0.1	0.1
115 VOLT, SINGLE PHASE, 60 Hz, TOTAL DOOR AMPS:				0.1

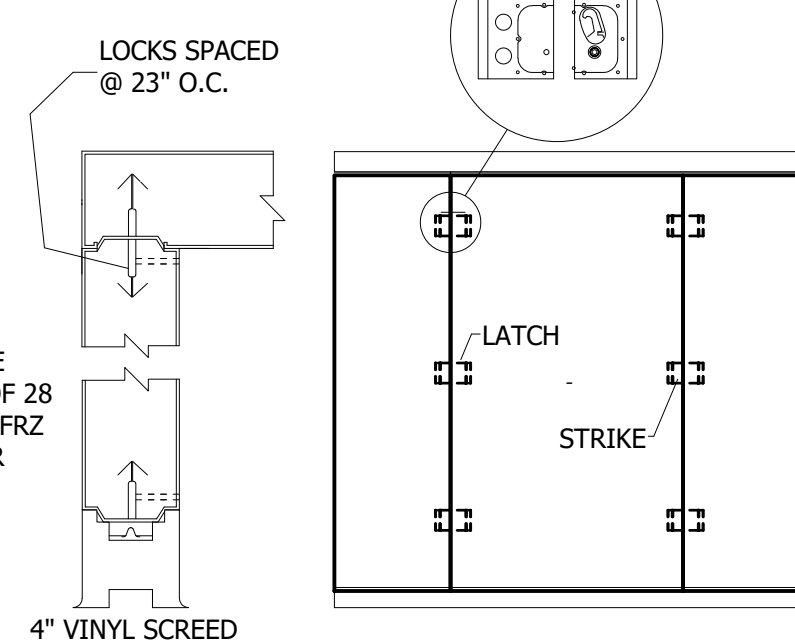
DOOR ELECTRICAL INFORMATION				
DESCRIPTION	QTY	VOLT	AMP	AMP LOAD
LED LIGHT	1	115	0.1	0.1
115 VOLT, SINGLE PHASE, 60 Hz, TOTAL DOOR AMPS:				0.1



1 DETAIL - 4IN VSCD  
Scale: NTS

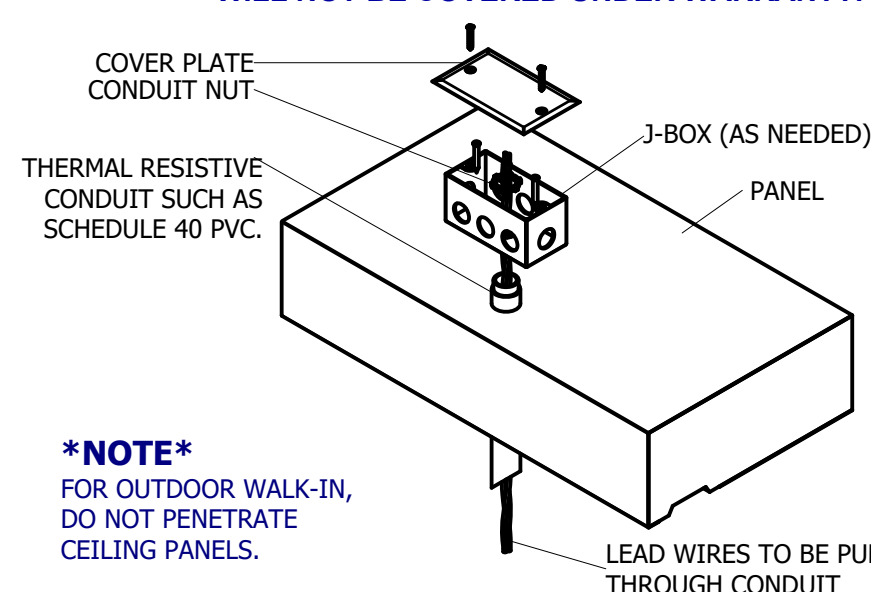


2 DETAIL - 4IN VSCD WITH HEATER WIRE  
Scale: NTS



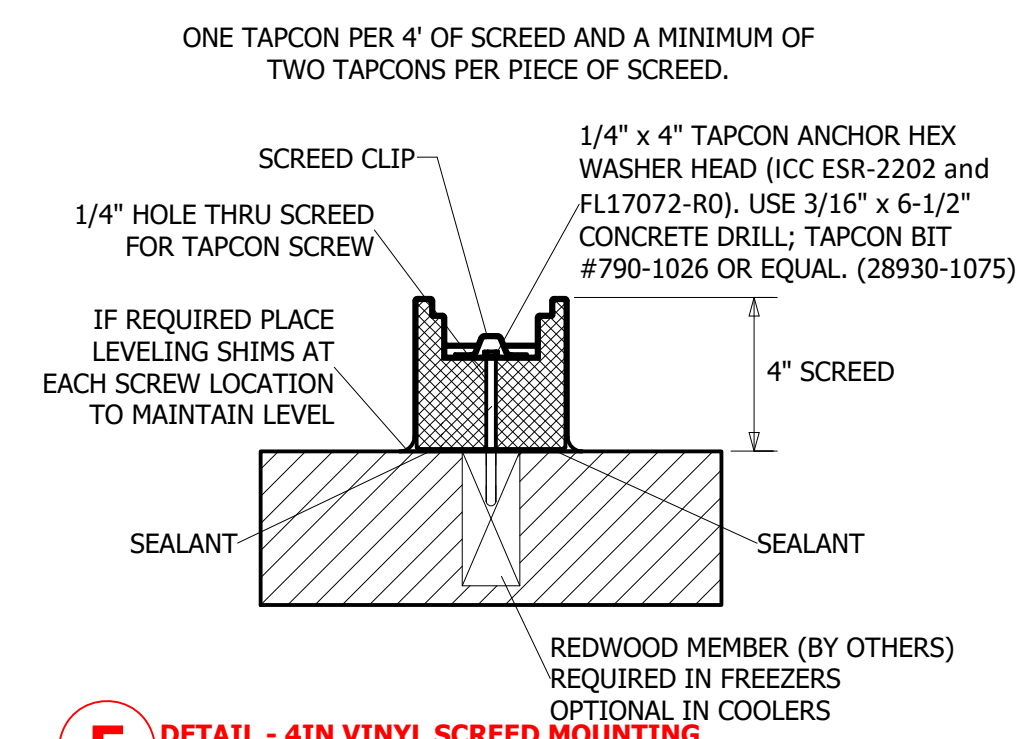
3 DETAIL - PANEL CONNECTION AT 4IN VINYL SCREENS  
Scale: NTS

AT EVERY ENTRANCE CONDUIT, FORCE SEALANT AROUND THE EXTERIOR OF THE ELECTRICAL CONDUIT AND INSIDE THE CONDUIT AROUND THE WIRES. FAILURE TO ELIMINATE AIRFLOW IN THE CONDUIT WILL ALLOW MOISTURE TO DAMAGE ELECTRICAL COMPONENTS ESPECIALLY LIGHTS WHICH WILL NOT BE COVERED UNDER WARRANTY.



\*NOTE\*  
FOR OUTDOOR WALK-IN,  
DO NOT PENETRATE  
CEILING PANELS.

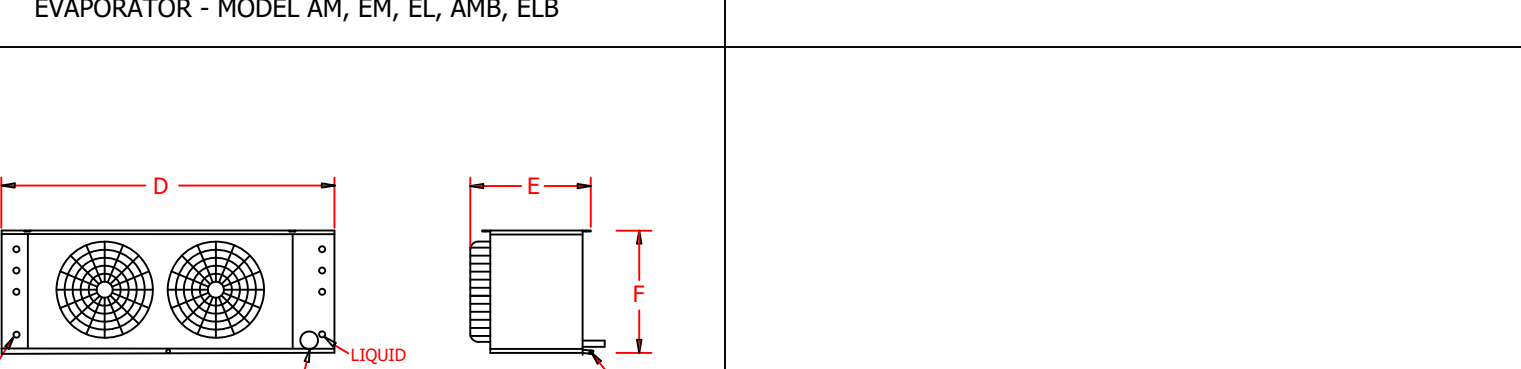
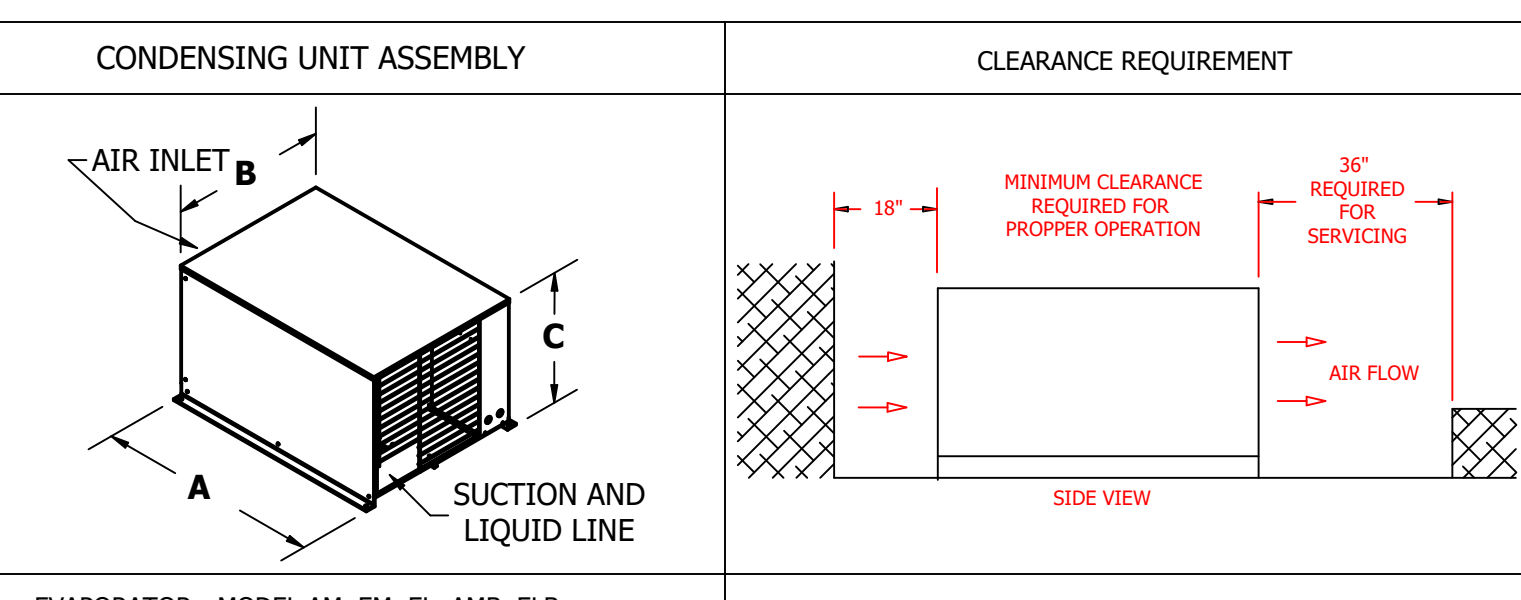
4 DETAIL - ELECTRICAL CONDUIT PENETRATION  
Scale: NTS



5 DETAIL - 4IN VINYL SCREED MOUNTING  
Scale: NTS

COMPARTMENT		CONDENSING UNIT																					
DESCRIPTION	TEMP F	QTY	MODEL#	REFRIGERANT	COMPRESSOR TYPE	DIMENSIONS				COMPRESSOR				CONDENSER FAN MTR			TOTAL AMPS	MX AMP DISC	CONNECTIONS O.D.		RCV CAP @ 90% FULL (lbs)		
						L (A)	W (B)	H (C)	LBS	HP	RLA	LRA	V	HZ	Φ	FLA			V	Φ		SUCT	LIQ
F01 FREEZER	-10	1	KPC299LOP-2EP	R404A	HERMETIC	33	40.125	22.25	219	3	19	105	208-230	60	1	2.2	208-230	1	21.4	40	7/8	3/8	13.6
C01 PRODUCE CLR	35	1	KPC69MZOP-2EP	R404A	SCROLL	33	25.5	19.25	152	3/4	6.3	48	208-230	60	1	0.5	208-230	1	7	15	5/8	3/8	5.8
C02 MEAT CLR	35	1	KPC69MOP-2EP	R404A	HERMETIC	33	25.5	19.25	152	3/4	6.8	33.7	208-230	60	1	0.5	208-230	1	7.4	15	5/8	3/8	5.8

COMPARTMENT		UNIT COOLER														
DESCRIPTION	TEMP F	QTY	MODEL # (DEFROST: A-AIR E-ELECTRIC)	REFRIGERANT	DIMENSIONS			FAN		HEATER			CONNECTIONS O.D.			
					L (D)	W (E)	H (F)	LBS	TOTAL AMPS	V	TOTAL AMPS	V	Φ	SUCT	LIQ	DRAIN
F01 FREEZER	-10	1	KEL36-121-2EC-PR-4	R404A	60.125	15.5	16.76	78	1.5	208-230	14.3	208-230	1	1 1/8	3/8	3/4
C01 PRODUCE CLR	35	1	KAM26-094-1EC-PR-4	R404A	43.625	15.5	16.75	55	1.6	115	0	N/A	0	5/8	3/8	3/4
C02 MEAT CLR	35	1	KAM26-073-1EC-PR-4	R404A	43.625	15.5	16.75	52	1.6	115	0	N/A	0	5/8	3/8	3/4



DRAWING #: A210176R2  
UNIT #: 001  
ORDER #:



CTR FOR FORENSIC PSYCHIATRY - COMBO  
SALINE, MI 48176 USA

STAFFORD SMITH INC

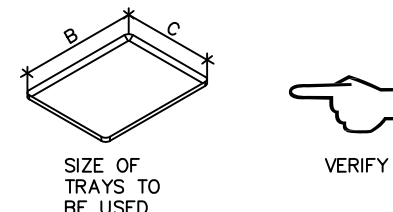
DATE	
QUOTE REVISION	
DATE	
CHECK BY	
DATE	01/31/2022
DRAWN BY	KAD





THE DESIGN CONCEPT SHOWN ON THIS SHEET IS JUST FOR A PRELIMINARY PRESENTATION PURPOSE ONLY


**NOTES:**

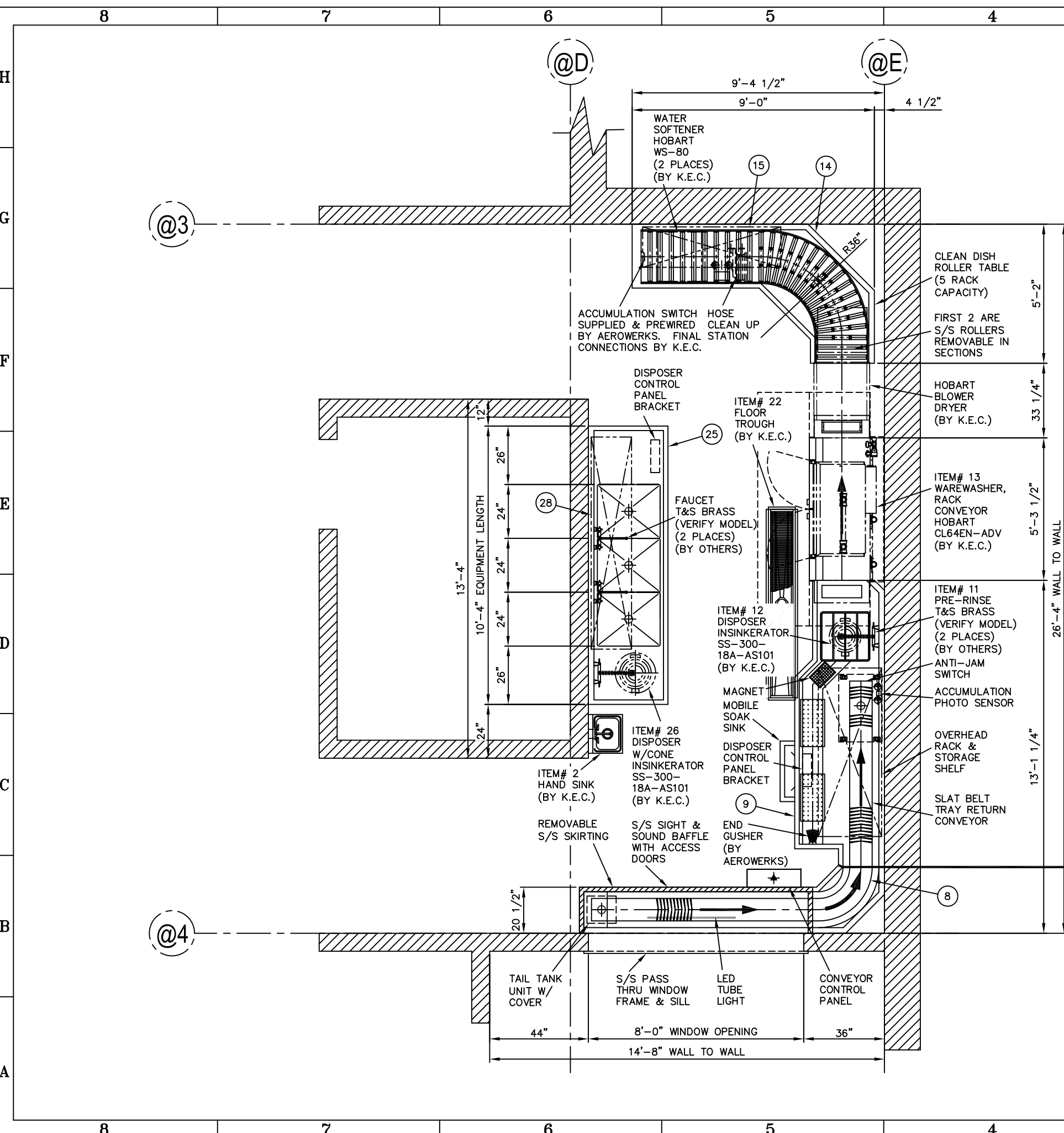
- K.E.C. TO SHIP DISPOSER COLLAR #6 TO AEROWERKS FOR WELDING IN SHOP.
- FIELD JOINTS SHOWN ON THIS DRAWING ARE PROPOSED ONLY. FINAL QUANTITY AND LOCATION OF FIELD JOINTS TO BE VERIFIED AT TIME OF APPROVAL.
- 

SIZE OF TRAYS TO BE USED

VERIFY

EQUIPMENT LIST (BY AEROWERKS)		
ITEM #	DESCRIPTION	QTY
8	SOILED TRAY CONVEYOR	
9	SOILED DISHTABLE	1
14	DISHTABLE	1
15	SHELF	1
25	3 COMPARTMENT SINK	1
28	SHELF	1

01/27/22	ISSUED FOR EQUIPMENT'S CONCEPT PRESENTATION PURPOSE	V.R.
MM/DD/YY	DESCRIPTION	BY
<b>AEROWERKS</b>		
<b>PRELIMINARY LAYOUT</b>		
JOB NAME: CENTER FOR FORENSIC PSYCHIATRY, SALINE, MI		
TITLE: ITEM# 8, 9, 14, 15, 25 & 28 PRELIMINARY PLAN VIEW		
DRAWN BY: V.R.	DATE: 01/27/22	
SCALE: 1/2" = 1'-0"	SIZE: D	SHEET: 01
DRAWING NO. P221783		



FIELD JOINT

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

- A. This Section includes mechanical general administrative and procedural requirements. The following requirements are included in this Section to supplement the requirements specified in Division 01 Specification Sections.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

1. AABC - Associated Air Balance Council; [www.aabc.com](http://www.aabc.com).
2. AASHTO - American Association of State Highway and Transportation Officials; [www.transportation.org](http://www.transportation.org).

3. ABMA - American Bearing Manufacturers Association; [www.americanbearings.org](http://www.americanbearings.org).
4. ABMA - American Boiler Manufacturers Association; [www.abma.com](http://www.abma.com).
5. AGA - American Gas Association; [www.aga.org](http://www.aga.org).
6. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); [www.ahrinet.org](http://www.ahrinet.org).
7. AMCA - Air Movement and Control Association International, Inc.; [www.amca.org](http://www.amca.org).
8. ANSI - American National Standards Institute; [www.ansi.org](http://www.ansi.org).
9. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; [www.ashrae.org](http://www.ashrae.org).
10. ASME - ASME International; (American Society of Mechanical Engineers); [www.asme.org](http://www.asme.org).
11. ASSE - American Society of Sanitary Engineering; [www.asse-plumbing.org](http://www.asse-plumbing.org).
12. ASTM - ASTM International; [www.astm.org](http://www.astm.org).
13. AWS - American Welding Society; [www.aws.org](http://www.aws.org).
14. AWWA - American Water Works Association; [www.awwa.org](http://www.awwa.org).
15. CDA - Copper Development Association; [www.copper.org](http://www.copper.org).
16. CGA - Compressed Gas Association; [www.cganet.com](http://www.cganet.com).
17. CISPI - Cast Iron Soil Pipe Institute; [www.cispi.org](http://www.cispi.org).
18. CSA - CSA International; (Formerly: IAS - International Approval Services); [www.csa-international.org](http://www.csa-international.org).
19. CSI - Construction Specifications Institute (The); [www.csiresources.org](http://www.csiresources.org).
20. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); [www.cti.org](http://www.cti.org).
21. FM Approvals - FM Approvals LLC; [www.fmglobal.com](http://www.fmglobal.com).
22. HI - Hydraulic Institute; [www.pumps.org](http://www.pumps.org).
23. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
24. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); [www.ieee.org](http://www.ieee.org).
25. IGSHPA - International Ground Source Heat Pump Association; [www.igshpa.okstate.edu](http://www.igshpa.okstate.edu).
26. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); [www.intertek.com](http://www.intertek.com).
27. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; [www.mss-hq.org](http://www.mss-hq.org)
28. NADCA - National Air Duct Cleaners Association; [www.nadca.com](http://www.nadca.com).
29. NAIMA - North American Insulation Manufacturers Association; [www.naima.org](http://www.naima.org).
30. NEBB - National Environmental Balancing Bureau; [www.nebb.org](http://www.nebb.org).
31. NECA - National Electrical Contractors Association; [www.necanet.org](http://www.necanet.org).
32. NEMA - National Electrical Manufacturers Association; [www.nema.org](http://www.nema.org).
33. NETA - InterNational Electrical Testing Association; [www.netaworld.org](http://www.netaworld.org).
34. NFPA - National Fire Protection Association; [www.nfpa.org](http://www.nfpa.org).
35. NSF - NSF International; [www.nsf.org](http://www.nsf.org).
36. NSPE - National Society of Professional Engineers; [www.nspe.org](http://www.nspe.org).
37. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; [www.smacna.org](http://www.smacna.org).
38. STI - Steel Tank Institute; [www.steeltank.com](http://www.steeltank.com).
39. TEMA - Tubular Exchanger Manufacturers Association, Inc.; [www.tema.org](http://www.tema.org).
40. UL - Underwriters Laboratories Inc.; [www.ul.com](http://www.ul.com).
41. USGBC - U.S. Green Building Council; [www.usgbc.org](http://www.usgbc.org).

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Systems Components Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

#### 1.5 QUALITY ASSURANCE

- A. Scope of Work: Furnish all labor, material, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the mechanical systems as specified and as indicated on Drawings.
  - 1. Contract Documents are complimentary, and what is required by one shall be as binding as if required by all. In the event of inconsistencies or disagreements within the Construction Documents bids shall be based on the most expensive combination of quality and quantity of the work indicated.
- B. Ordinances and Codes: Perform all Work in accordance with applicable Federal, State and local ordinances and regulations, the Rules and Regulations of ASHRAE, NFPA, SMACNA and UL, unless otherwise indicated.
  - 1. Notify the Architect/Engineer in writing before submitting a proposal should any changes in Drawings or Specifications be required to conform to the above codes, rules or regulations.
  - 2. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without notice to A/E, the Contractor shall bear all costs arising from corrective measures.
- C. Source Limitations: Obtain equipment and other components of the same or similar systems through one source from a single manufacturer.
- D. Tests and Inspections: Perform all tests required by state, city, county and/or other agencies having jurisdiction. Provide all materials, equipment, etc., and labor required for tests.
- E. Performance Requirements: Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the trades involved.
- F. Sequence and Schedule: Perform work to avoid interference with the work of other trades. Remove and relocate work which in the opinion of the Owner's Representatives causes interference.
- G. Labeling Requirement for Packaged Equipment: Electrical panels on packaged mechanical equipment shall bear UL label or label of other Nationally Recognized Testing Laboratory (NRTL) (Intertek, CSA, etc.).

#### 1.6 CODES, PERMITS AND FEES

- A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for Mechanical Work shall be secured and paid for by the Contractor. All Work shall conform to all applicable codes, rules and regulations.
- B. Rules of local utility companies shall be complied with. Check with each utility company supplying service to the installation and determine all devices including, but not limited to, all valves, meter boxes, and meters which will be required and include the cost of all such items in proposal.
- C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.
- D. Refer to Division 22 Section "Domestic Water Piping" for purchase and installation of potable water meters.

#### 1.7 DRAWINGS

- A. The drawings show the location and general arrangement of equipment, piping and related items. They shall be followed as closely as elements of the construction will permit.
- B. Examine the drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly. Provide fittings, valves, and accessories as required to meet actual conditions.
- C. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.
- D. The Architectural and Structural Drawings take precedence in all matters pertaining to the building structure, Mechanical Drawings in all matters pertaining to Mechanical Trades and Electrical Drawings in all matters pertaining to Electrical Trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.
- E. Drawings are not intended to be scaled for rough-in or to serve as shop drawings. Take all field measurements required to complete the Work.

#### 1.8 MATERIAL AND EQUIPMENT MANUFACTURERS

- A. Equipment: All items of equipment shall be furnished complete with all accessories normally supplied with the catalog items listed and all other accessories necessary for a complete and satisfactory operating system. All equipment and materials shall be new and shall be standard products of manufacturers regularly engaged in the production of plumbing, heating, ventilating and air conditioning equipment and shall be the manufacturer's latest design.
- B. If an approved manufacturer is other than the manufacturer used as the basis for design, the equipment or product provided shall be equal in size, quality, durability,



appearance, capacity, and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system and shall comply with the requirements for Items Requiring Prior Approval specified in this section of the Specifications. All costs to make these items of equipment comply with these requirements including, but not limited to, piping, sheet metal, electrical work, and building alterations shall be included in the original Bid.

- C. All package unit equipment and skid mounted mechanical components that are factory assembled shall meet, in detail, the products named and specified within each section of the Mechanical and Electrical Specifications.
- D. Changes Involving Electrical Work: The design of the mechanical systems is based on the equipment scheduled on the Drawings. Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified with no additional cost to project. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
  - 1. Where equipment changes are made that involve additional Electrical Work (larger size motor, additional wiring of equipment, etc.) the Mechanical Trades involved shall compensate the Electrical Trades for the cost of the additional Work required.

#### 1.9 INSPECTION OF SITE

- A. Visit the site, examine and verify the conditions under which the Work must be conducted before submitting Proposal. The submitting of a Proposal implies that the Contractor has visited the site and understands the conditions under which the Work must be conducted. No additional charges will be allowed because of failure to make this examination or to include all materials and labor to complete the Work.
- B. No contract sum adjustments or contract time extensions will be made for Contractor claims arising from conditions which were or could have been observable, ascertainable or reasonably foreseeable from a site visit or inquiry into local conditions affecting the execution of the work.

#### 1.10 ITEMS REQUIRING PRIOR APPROVAL

- A. Bids shall be based upon manufactured equipment specified. All items that the Contractor proposes to use in the Work that are not specifically named in the Contract Documents must be submitted for review prior to bids. Such items must be submitted in compliance with Division 01 specifications. Requests for prior approval must be accompanied by complete catalog information, including but not limited to, model, size, accessories, complete electrical information and performance data in the form given in the equipment schedule on the drawings at stated design conditions. Where items are referred to by symbolic designations on the drawings, all requests for prior approval shall bear the same designations.
  - 1. Equipment to be considered for prior approval shall be equal in quality, durability, appearance, capacity and efficiency through all ranges of operation, shall fulfill the requirements of equipment arrangement and space limitations of the equipment shown on the plans and/or specified and shall be compatible with the other components of the system.

2. All costs incurred to make equipment comply with other requirements, including providing maintenance, clearance, piping, sheet metal, electrical, replacement of other components, and building alterations shall be included in the original bid.

- B. Voluntary alternates may be submitted for consideration, with listed addition or deduction to the bid, but will not affect the awarding of the contract.

#### 1.11 SUBMITTALS

- A. Submit project specific submittals for review in compliance with Division 01.
- B. Prepare shop drawings to scale for the Architect/Engineer for review. Equipment and material submittals required are indicated in the Mechanical; Fire Suppression; Plumbing; and Heating, Ventilating and Air Conditioning Sections. Refer to Division 01 for submittal quantities.
- C. All submittals shall be submitted in groupings of similar and/or related items. Plumbing fixture submittals shall be submitted as one package including all fixtures intended to be used for this project. Incomplete submittal groupings will be returned "Rejected". Submit shop drawing with identification mark number or symbol numbers as specified or scheduled on the Mechanical Drawings.
- D. All submittals shall be project specific. Standard detail drawings and schedule not clearly indicating which data is associated with this Project will be returned "Rejected".
- E. Shop drawings shall be reviewed by the Mechanical Contractor for completeness and accuracy prior to submitting to the Architect/Engineer for review. The shop drawings shall be dated and signed by the Mechanical Contractor prior to submission.
- F. No equipment shall be shipped from stock or fabricated until shop drawings for them have been reviewed by the Architect/Engineer. Review is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Any action indicated is subject to the requirement of the plans and specifications.
  1. By the review of shop drawings, the Architect/Engineer does not assume responsibility for actual dimensions or for the fit of completed work in position, nor does such review relieve Mechanical Trades of full responsibility for the proper and correct execution of the work required.
  2. Contractor is responsible for:
    - a. Dimensions, which shall be confirmed and correlated at the job site.
    - b. Fabrication processes and techniques of construction.
    - c. Quantities.
    - d. Coordination of Contractor's work with all other trades.
    - e. Satisfactory performance of Contractor's work.
    - f. Temporary aspects of the construction process.
- G. Submit detailed shop drawings of piping systems showing pipe routing and types and locations of all pipe hangers.
- H. If deviations (not substitutions) from Contract Documents are deemed necessary by the Contractor, details of such deviations, including changes in related portions of

the project and the reasons therefore, shall be submitted with the submittal for approval.

#### 1.12 COORDINATION DRAWINGS

- A. Submit project specified coordination drawings for review in compliance with Division 01 Specification Sections.

#### 1.13 OPERATION AND MAINTENANCE INSTRUCTIONAL MANUALS

- A. Submit project specific Operation and Maintenance Instructional Manuals for review in compliance with Division 01 Specification Sections.
- B. Provide complete operation and maintenance instructional manuals covering all mechanical equipment herein specified, together with parts lists. Provide 2 paper copies and 1 PDF Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. One copy of all manuals shall be furnished for Owner. Maintenance and operating instructional manuals shall be provided when construction is approximately 75 percent complete.
- C. Format: Submit operations and maintenance manuals in the following format:
  - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
    - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    - b. Enable inserted reviewer comments on draft submittals.
- D. Operation and maintenance instructional manuals shall be submitted a minimum of four (4) weeks prior to functional testing.
- E. The operating and maintenance instructions shall include a brief, general description for all mechanical systems including, but not limited to:
  - 1. Routine maintenance procedures.
  - 2. Lubrication chart listing all types of lubricants to be used for each piece of equipment and the recommended frequency of lubrication.
  - 3. Trouble-shooting procedures.
  - 4. Contractor's telephone numbers for warranty repair service.
  - 5. Submittals.
  - 6. Recommended spare parts lists.
  - 7. Names and telephone numbers of major material suppliers and subcontractors.
  - 8. System schematic drawings.

#### 1.14 RECORD DRAWINGS

- A. Submit record drawings in compliance with Division 01.
- B. Contractor shall submit to the Architect/Engineer, record drawings on electronic media or vellum which have been neatly marked to represent as-built conditions for all new mechanical work.

- C. The Contractor shall keep accurate note of all deviations from the construction documents and discrepancies in the underground concealed conditions and other items of construction on field drawings as they occur. The marked up field documents shall be available for review by the Architect, Engineer and Owner at their request.

#### 1.15 INSTRUCTION OF OWNER PERSONNEL

- A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of mechanical equipment and systems at agreed upon times. A minimum of 24 hours of formal instruction to Owner's personnel shall be provided for each building. Additional hours are specified in individual specification sections.
- B. For equipment requiring seasonal operation, perform instructions for other seasons within six months.
- C. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- D. In addition to individual equipment training provide overview of each mechanical system. Utilize the as-built documents for this overview.
- E. Prepare and insert additional data in operation and maintenance manual when need for such data becomes apparent during instruction.

#### 1.16 WARRANTY

- A. Warranty: Comply with the requirements in Division 01 Specification Sections. Contractor shall warranty that the mechanical installation is free from defects and agrees to replace or repair, to the Owner's satisfaction, any part of this mechanical installation which becomes defective within a period of one year (unless specified otherwise in other Mechanical; Fire Suppression; Plumbing; or Heating, Ventilating and Air Conditioning Sections) from the date of substantial completion following final acceptance, provided that such failure is due to defects in the equipment, material, workmanship or failure to follow the contract documents.
- B. File with the Owner any and all warranties from the equipment manufacturers including the operating conditions and performance capacities they are based on.

#### PART 2 - PRODUCTS (NOT APPLICABLE)

#### PART 3 - EXECUTION

##### 3.1 MECHANICAL DEMOLITION WORK

- A. All demolition of existing mechanical equipment and materials shall be done by the Contractor unless otherwise indicated. Include all items such as, but not limited to, existing piping, pumps, ductwork, supports and equipment where such items are not required for the proper operation of the modified system.

- B. Include draining of piping systems where required for demolition, modification of, or connection to existing systems.
- C. In general, demolition work is indicated on the Drawings. However, the Contractor shall visit the job site to determine the full extent and character of this Work.
- D. Unless specifically noted to the contrary, removed materials shall not be reused in the work. Salvaged materials that are to be reused shall be stored safe against damage and turned over to the appropriate trade for reuse. Salvaged materials of value that are not to be reused shall remain the property of the Owner unless such ownership is waived. Remove items from the systems and turn over to the Owner in their condition prior to removal. The Owner shall move and store these materials. Items on which the Owner waives ownership shall become the property of the Contractor, who shall remove and legally dispose of same, away from the premises.
- E. Work that has been cut or partially removed shall be protected against damage until covered by permanent construction.
- F. Clean and flush the interior and exterior of all existing relocated equipment and its related piping, valves, and accessories that are to be reused of all mud, debris, pipe dope, oils, welding slag, loose mill scale, rust and other extraneous material so that the existing equipment and all accessories can be repainted and repaired as required to place in first-class working condition.
- G. Where existing equipment is to be removed, cap piping under floor, behind face of wall, above ceiling or at mains. Cap or plug piping with same or compatible piping material.
- H. Cap ductwork and cap piping immediately adjacent to demolition as soon as demolition commences in order to allow existing systems to remain in operation.
  - 1. Cap or plug piping with same or compatible piping material.
  - 2. Cap or plug ducts with same or compatible ductwork material.

### 3.2 WORK IN EXISTING BUILDINGS

- A. The Owner will provide access to existing buildings as required. Access requirements to occupied buildings shall be identified on the project schedule. The Contractor, once Work is started in the existing building, shall complete same without interruption so as to return work areas as soon as possible to Owner.
- B. Adequately protect and preserve all existing and newly installed Work. Promptly repair any damage to same at Contractor's expense.
- C. Consult with the Owner's Representative as to the methods of carrying on the Work so as not to interfere with the Owner's operation any more than absolutely necessary. Accordingly, all service lines shall be kept in operation as long as possible and the services shall only be interrupted at such time as will be designated by the Owner's Representative.
- D. Prior to starting work in any area, obtain approval for doing so from a qualified representative of the Owner who is designated and authorized by the Owner to perform testing and abatement, if necessary, of all hazardous materials including but not limited to, asbestos. The Contractor shall not perform any inspection, testing, containment, removal or other work that is related in any way whatsoever to hazardous materials under the Contract.

### 3.3 TEMPORARY SERVICES

- A. Provide temporary service as described in Division 01.
- B. The existing building will be occupied during construction. Maintain mechanical services and provide necessary temporary connections and their removal at no additional cost to the Owner.

### 3.4 WORK INVOLVING OTHER TRADES

- A. Certain items of equipment or materials specified in the Mechanical Division may have to be installed by other trades due to code requirements or union jurisdictional requirements. In such instances, the Contractor shall complete the work through an approved, qualified subcontractor and shall include the full cost for same in proposal.

### 3.5 ACCEPTANCE PROCEDURE

- A. Upon successful completion of start-up and recalibration, but prior to building acceptance, substantial completion and commencement of warranties, the Architect/Engineer shall be requested in writing to observe the satisfactory operation of all mechanical control systems.
- B. The Contractor shall demonstrate operation of equipment and control systems, including each individual component, to the Owner and Architect/Engineer.
- C. After correcting all items appearing on the punch list, make a second written request to the Owner and Architect/Engineer for observation and approval.
- D. After all items on the punch list are corrected and formal approval of the mechanical systems is provided by the Architect/Engineer, the Contractor shall indicate to the Owner in writing the commencement of the warranty period.
- E. Operation of the following systems shall be demonstrated:
  - 1. Heating Systems.
  - 2. Cooling Systems.
  - 3. Air Terminal Units.
  - 4. Temperature Controls.
- F. For systems requiring seasonal operation, demonstrate system performance within six months when weather conditions are suitable.

END OF SECTION 200500

SECTION 200510 - BASIC MECHANICAL MATERIALS AND METHODS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."

2. Division 22 Section "Domestic Water Piping" for flushing and cleaning of potable water piping.
3. Division 23 Section "Piping Systems Flushing and Chemical Cleaning" for flushing and cleaning of HVAC piping.

## 1.2 SUMMARY

- A. This section includes mechanical materials and installation methods common to mechanical piping systems, sheet metal systems and equipment. This section supplements all other Division 20, 21, 22, and 23 Mechanical Sections, and Division 01 Specification Sections.

## 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
  1. ABS: Acrylonitrile-butadiene-styrene plastic.
  2. CPVC: Chlorinated polyvinyl chloride plastic.
  3. PE: Polyethylene plastic.
  4. PVC: Polyvinyl chloride plastic.
  5. RTRF: Reinforced thermosetting resin (fiberglass) fittings.
  6. RTRP: Reinforced thermosetting resin (fiberglass) pipe.
- G. The following are industry abbreviations for rubber materials:
  1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  2. NBR: Acrylonitrile-butadiene rubber.

## 1.4 SUBMITTALS

- A. Product Data: For the following:
  1. Transition fittings.
  2. Dielectric fittings.
  3. Mechanical sleeve seals.
  4. Escutcheons.



- B. Welding certificates.
- C. Brazing Certificates: As required by ASME Boiler and Pressure Vessel Code, Section IX, or AWS B2.2.

#### 1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- B. Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.
- C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.
- D. Comply with NSF 372, "Drinking Water System Components - Lead Content" for potable domestic water piping and components.
- E. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- F. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- G. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."
- H. Soldering: Qualify processes and operators according to AWS B2.3/2.3M, "Specification for Soldering Procedure and Performance Qualification."
- I. Installer Qualifications:
  - 1. Installers of Grooved Components: Installers shall be certified by the grooved component manufacturer as having been trained and qualified to join piping with grooved couplings, fittings, and specialties.
  - 2. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.
  - 3. Fiberglass Pipe and Fitting Installers: Installers of RTRF and RTRP shall be certified by the manufacturer of pipes and fittings as having been trained and qualified to join fiberglass piping with manufacturer-recommended adhesive.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection: Provide adequate weather protected storage space for all mechanical equipment and materials deliveries to the job site. Storage locations will

be designated by the Owner's Representative. Equipment stored in unprotected areas must be provided with temporary protection.

1. Protect equipment and materials from theft, injury or damage.
2. Protect equipment outlets, pipe and duct openings with temporary plugs or caps.
3. Materials with enamel or glaze surface shall be protected from damage by covering and/or coating as recommended in bulletin "Handling and Care of Enameled Cast Iron Plumbing Fixtures", issued by the Plumbing Fixtures Manufacturer Association, and as approved.
4. Electrical equipment furnished by Mechanical Trades and installed by the Electrical Trades: Turn over to Electrical Trades in good condition, receive written confirmation of same.
5. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
6. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

## 1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations. Coordinate with other trades to ensure accurate locations and sizes of mechanical spaces, chases, slots, shafts, recesses and openings.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Install Work to avoid interference with work of other trades including, but not limited to, Architectural and Electrical Trades. Remove and relocate any work that causes an interference at Contractor's expense.
- D. Coordinate requirements for and provide access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."
- E. The mechanical trades shall be responsible for all damage to other work caused by their work or through the neglect of their workers.
  1. All patching and repair of any such damaged work shall be performed by the trades which installed the work. The cost shall be paid by the Mechanical Trades.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

## 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 21, 22, and 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

## 2.3 JOINING MATERIALS

- A. Refer to individual Division 21, 22, and 23 piping Sections for special joining materials not listed below.
- B. Unions: Pipe Size 2 Inches and Smaller:
  - 1. Ferrous pipe: Malleable iron ground joint type unions.
  - 2. Unions in galvanized piping system shall be galvanized.
  - 3. Copper tube and pipe: Bronze unions with soldered joints.
- C. Flanges: Pipe Sizes 2-1/2 Inch and Larger:
  - 1. Ferrous pipe: Standard weight, forged steel weld neck flanges.
  - 2. Copper tube and pipe: Slip-on bronze flanges.
- D. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- E. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated. Square head bolts and nuts are not acceptable.
- F. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- G. Solder Filler Metals: ASTM B 32, lead-free, antimony-free, silver-bearing alloys. Include water-flushable flux according to ASTM B 813.
- H. Brazing Filler Metals: Alloys meeting AWS A5.8.
  - 1. Use Type BcuP Series, silver-bearing, copper-phosphorus alloys for joining copper or bronze socket fittings with copper pipe. Flux is prohibited unless used with bronze fittings.
  - 2. Use Type Bag Series, cadmium-free silver alloys for joining copper with steel, stainless steel, or other ferrous alloys.
- I. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

- J. Welding Materials: Comply with Section II, Part C, of ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.
- K. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.
- L. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- M. Solvent Cements for Joining ABS Piping: ASTM D 2235.
- N. Solvent Cements for Joining PVC to ABS Piping Transition: ASTM D 3138.
- O. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

#### 2.4 PIPE THREAD COMPOUNDS

- A. Pipe thread compounds for the fluid service compatible with piping materials provided.
- B. Compounds for potable water service and similar applications acceptable to U.S. Department of Agriculture (USDA) or Food and Drug Administration (FDA). Compounds containing lead are prohibited.
- C. Inorganic zinc-rich coatings or corrosion inhibited proprietary compounds for galvanized carbon steel systems to coat raw carbon steel surfaces, in lieu of subsequent painting.
  - 1. Manufacturers:
    - a. Carboline "Carbo-Zinc 12."
    - b. Tnemec.
    - c. Koppers.
- D. Graphite and oil or proprietary corrosion inhibited compounds suitable for system temperatures for steam or condensate.
  - 1. Manufacturers:
    - a. WKM; Division of Cooper Industries, Inc., Key "Graphite Paste."
    - b. Other approved.
- E. Use tetrafluoroethylene (Teflon) tape 2 to 3 mils thick for natural gas system threaded joints.
  - 1. Manufacturers:
    - a. Cadillac Plastic.
    - b. Permacel.
    - c. Other approved.

## 2.5 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Dresser Industries, Inc.; DMD Div.
    - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
    - d. JCM Industries.
    - e. Smith-Blair, Inc.
    - f. Viking Johnson.
  2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
  3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
  4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
1. Manufacturers:
    - a. IPEX Inc. (formerly Eslon Thermoplastics).
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
1. Manufacturers:
    - a. Thompson Plastics, Inc.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
1. Manufacturers:
    - a. NIBCO INC.
    - b. NIBCO, Inc.; Chemtrol Div.
- E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Fernco, Inc.
    - c. Mission Rubber Company.
    - d. Plastic Oddities, Inc.
    - e. Can-Tex Industries Division of Harsco Corp. "CT-Adaptors".
    - f. Joint Inc., "Caulder".

## 2.6 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Brass Unions, Brass Nipples, Brass Couplings: For systems up to 286 deg F.
- D. Dielectric-Flange Kits: Include full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  - 1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Capitol Manufacturing Co.
    - d. Central Plastics Company.
    - e. Epco Sales, Inc.
    - f. Pipeline Seal and Insulator, Inc.
    - g. Watts Water Technologies, Inc.; Watts Regulator Co.
    - h. Zurn Industries, Inc.; Wilkins Div.
  - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

## 2.7 MODULAR MECHANICAL SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve or pipe and core drilled hole.
  - 1. Manufacturers:
    - a. Advance Products & Systems, Inc.; Innerlynx.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.; Thunderline Link Seal.
  - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 3. Pressure Plates: Carbon steel. Include two for each sealing element.
  - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.8 SLEEVES

- A. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, and 0.375 inch wall black.
- B. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, and 0.375 inch wall galvanized, plain ends.
- C. Water Stop: Cast or ductile-iron; fabricated steel; PVC; or rotationally molded HDPE pipe; with plain ends and integral water stop, unless otherwise indicated.

1. Manufacturers:
  - a. Advance Products & Systems, Inc.; Infinity and Gal-Vo-Plast Sleeves.
  - b. Calpico, Inc.
  - c. Metraflex Co.
  - d. Pipeline Seal and Insulator, Inc.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  1. Underdeck Clamp: Clamping ring with set screws.

## 2.9 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
  1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping or Piping in High Humidity Areas: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    - d. Bare Piping in Finished Spaces: One-piece, stamped-steel type.
    - e. Bare Piping in Unfinished Service Spaces or Equipment Rooms: Split-plate, stamped-steel type with concealed hinge and set screw.
  2. Existing Piping: Use the following:
    - a. Chrome-Plated Piping or Piping in High Humidity Areas: Split-casting, cast-brass type with chrome-plated finish.
    - b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
    - c. Bare Piping: Split-plate, stamped-steel type with set screw or spring clips.

## 2.10 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  2. Design Mix: 5000-psi, 28-day compressive strength.
  3. Packaging: Premixed and factory packaged.

## 2.11 EPOXY BONDING COMPOUND

- A. Two-component system suitable for bonding wet or dry concrete to each other and to other materials.
- B. Manufacturers:

1. Euco 452 #450; Euclid Chemical Co.
2. Epobond; L & M Construction Chemicals.
3. Sikadur 87; Sika Corp.

## 2.12 LEAK DETECTOR SOLUTION

A. Commercial leak detector solution for pipe system testing.

B. Manufacturers:

1. American Gas and Chemicals Inc.; Leak Tec.
2. Cole-Parmer Inst. Co.; Leak Detector.
3. Guy Speaker Co. Inc.; Squirt 'n Bubbles.

## 2.13 PIPE ROOF PENETRATION ENCLOSURES

A. Manufacturers:

1. Pate Company (The); pca Series.
2. Portals Plus, Inc.
3. Thybar Corporation; Thycurb.

B. Prefabricated roof curb with:

1. Minimum 18 gage welded galvanized steel construction.
2. Integral base plate.
3. Factory installed insect and decay resistant wood nailer.
4. Factory installed 1-1/2 inch thick, 3 pounds per cubic foot density rigid insulation.
5. EPDM compression molded rubber cap for single or multiple pipes as required.
6. Stainless steel draw-band clamps.

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Refer to piping application schedules on the Drawings.

B. Install piping according to the following requirements and Division 21, 22, and 23 Sections specifying piping systems, and in accordance with manufacturer's instructions.

C. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. The Drawings shall be followed as closely as elements of construction will permit.

D. During the progress of construction, protect open ends of pipe, fittings, and valves to prevent the admission of foreign matter. Place plugs or flanges in the ends of all installed work whenever work stops. Plugs shall be commercially manufactured products.



- E. Prior to and during laying of pipe, maintain excavations dry and clear of water and extraneous materials. Provide minimum 4 inches of clearance in all directions for pipe passing under or through building grade beams.
- F. Weld-o-lets and thread-o-lets can be used for annular flow measuring devices, temperature control components, and thermal wells in steel pipe. Pipe taps shall be drilled and deburred. Torch cutting is not acceptable.
- G. Brazolets can be used for annular flow measuring devices, temperature control components, and thermal wells in copper tube. Pipe taps shall be drilled and deburred. Torch cutting is not acceptable.
- H. Clean and lubricate elastomer joints prior to assembly.
- I. Clean damaged galvanized surfaces and touch-up with a zinc rich coating.
- J. Install piping to conserve building space and not interfere with use of space.
- K. Group piping whenever practical at common elevations.
- L. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
  - 1. Install piping to allow for expansion and contraction at locations where piping crosses building or structure expansion joints.
- M. Slope piping and arrange systems to drain at low points.
- N. Slope horizontal piping containing noncondensable gases 1 inch per 100 feet, upward in the direction of the flow.
- O. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- P. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- Q. In concealed locations where piping, other than black steel, cast-iron, or galvanized steel, is installed through holes or notches in studs, joists, rafters or similar members less than 1-1/2 inches from the nearest edge of the member, the pipe shall be protected by shield plates. Protective shield plates shall be a minimum of 1/16 inch thick steel, shall cover the area of the pipe where the member is notched or bored, and shall extend a minimum of 2 inches above sole plates and below top plates.
- R. Do not penetrate building structural members unless specifically indicated on drawings.
- S. Install piping above accessible ceilings to allow sufficient space for ceiling panel and light fixture removal.
- T. Install valves with stems upright or horizontal, not inverted.
- U. Provide clearance for installation of insulation and access to valves and fittings.

- V. Install piping to permit valve and equipment servicing. Do not install piping below valves and/or terminal equipment. Do not install piping above electrical equipment.
- W. Install piping at indicated slopes. Provide drain valves with hose end connections and caps at all piping low points, where piping is trapped and at all equipment.
- X. Install piping free of sags and bends.
- Y. Install fittings for changes in direction and branch connections.
- Z. Unless otherwise indicated or specified, install branch connections to mains using tee fittings in main pipe:
  - 1. Branch connected to bottom of main pipe for HVAC systems. Side connection is acceptable. Connection above centerline of main is unacceptable. For up-feed risers, connect branch to top of main pipe.
  - 2. Branch connected to top of main for steam and condensate, plumbing systems, compressible gasses, and vacuum.
- AA. Install piping to allow application of insulation.
- BB. Select system components with pressure rating equal to or greater than system operating pressure.
- CC. After completion, fill, clean, and treat systems. Refer to Division 23 Sections "Hydronic Piping," "Piping Systems Flushing and Chemical Cleaning," and "HVAC Water Treatment."
- DD. Install escutcheons for penetrations of walls below ceiling, and ceilings.
- EE. Sleeves are not required for core-drilled holes in poured concrete walls.
- FF. Permanent sleeves are not required for holes formed by removable PE sleeves in poured concrete walls.
- GG. Install sleeves for pipes passing through footings and foundation walls, masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces of walls.
    - a. Exception: Extend sleeves installed in floors 2 inches above finished floor level.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Schedule 40 Black Steel Sleeves: For pipes smaller than NPS 12 penetrating interior walls.
    - b. 0.375 Inch Wall Black Steel Sleeves: For pipes NPS 12 and larger penetrating interior walls.
    - c. Schedule 40 Galvanized Steel Sleeves: For pipes smaller than NPS 12 penetrating floors, and roof slabs.
    - d. 0.375 Inch Wall Galvanized Steel Sleeves: For pipes NPS 12 and larger penetrating floors and roof slabs.

- e. For pipes penetrating floors with membrane water proofing provide cast iron sleeve with clamping flanges. Secure/seal membrane to sleeves with clamping flanges.
  4. Seal sleeves in concrete floors roof slabs and masonry walls with grout.
  5. Seal sleeves in plaster/gypsum board partitions with plaster or dry wall compound and caulk with non-hardening silicone sealant to provide airtight installation.
  6. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- HH. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and modular mechanical seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing modular mechanical seals.
1. Install Schedule 40 galvanized steel pipe for sleeves smaller than 12 inches in diameter.
  2. Install 0.375 galvanized steel pipe for sleeves 12 inches and larger in diameter.
  3. Modular Mechanical Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble modular mechanical seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- II. New, Poured Concrete, Underground, Exterior-Wall and Slab on Grade Pipe Penetrations: Install water stop sleeves prior to pour. Seal pipe penetrations using modular mechanical seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing modular mechanical seals.
1. Modular Mechanical Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble modular mechanical seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- JJ. Existing Underground, Exterior-Wall and Slab on Grade Pipe Penetrations: Seal core drilled pipe penetrations using modular mechanical seals. Allow for 1-inch annular clear space between pipe and cored opening for installing modular mechanical seals.
1. Modular Mechanical Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of cored hole. Assemble modular mechanical seals and install in annular space between pipe and cored opening. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- KK. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.
1. Seal openings around pipes in sleeves through walls, floors and ceilings, and where floors, fire rated walls and smoke barriers are penetrated. Firestop materials shall be UL listed and shall have a fire rating equal to or greater than the penetrated barrier.
  2. Refer to Division 07 Specification Sections for materials and UL Classified firestop systems.

LL. Pipe Roof Penetration Enclosures:

1. Coordinate delivery of roof penetration enclosures to jobsite.
2. Locate and set curbs on roof.
3. Framing, flashing, and attachment to roof structure are specified under Division 07.
4. Attach cap to curbs, cut pipe boots to fit pipe, and clamp boots to pipe or conduit.

MM. Verify final equipment locations for roughing-in.

NN. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 21, 22, and 23 Sections specifying piping systems.
- B. Cut piping square.
- C. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- D. Remove scale, slag, dirt, oil, and debris from inside and outside of pipe and fittings before assembly.
- E. Clean damaged galvanized surfaces and touch-up with a zinc rich coating.
- F. Use standard long sweep pipe fittings for changes in direction. No mitered joints or field fabricated pipe bends will be permitted. Short radius elbows may be used where specified or specifically authorized by the Architect.
- G. Make tee connections with screwed tee fittings, soldered fittings or specified welded connections. Make welded branch connections with either welding tees or forged branch outlet fittings in accordance with ASTM A234, ANSI B16.9 and ANSI B16.11. For forged branch outlets, furnish forged fittings flared for improved flow where attached to the run, reinforced against external strains and to full pipe-bursting strength requirements. "Fishmouth" connections are not acceptable.
- H. Use eccentric reducers for drainage and venting of pipe lines; bushings are not permitted.
- I. Provide pipe openings using fittings for all systems control devices, thermometers, gauges, etc. Drilling and tapping of pipe wall for connections is prohibited.
- J. Provide temperature sensing device thermal wells and similar piping specialty connections.
- K. Provide instrument connections except thermal wells with specified isolating valves at point of connection to system.
- L. Locate instrument connections in accordance with manufacturer's instructions for accurate read-out of function sensed. Locate instrument connections for easy reading and service of devices.

- M. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- N. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- O. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- P. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
  - 1. Weld-o-lets and thread-o-lets can be used for annular flow measuring devices, temperature control components, and thermal wells. Pipe taps shall be drilled and deburred. Torch cutting is not acceptable.
- Q. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on gaskets and bolt threads.
  - 1. Assemble flanged joints with fresh-stock gasket and hex head nuts, bolts or studs. Make clearance between flange faces such that the connections can be gasketed and bolted tight without strain on the piping system. Align flange faces parallel and bores concentric; center gaskets on the flange faces without projection into the bore.
  - 2. Lubricate bolts before assembly to insure uniform bolt stressing. Draw up and tighten bolts in staggered sequence to prevent unequal gasket compression and deformation of the flanges. Do not mate a flange with a raised face to a companion flange with a flat face; machine the raised face down to a smooth matching surface and use a full face gasket. After the piping system has been tested and is in service at its maximum temperature, check bolting torque to provide required gasket stress.
- R. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials. Refer to Application Schedules on the Drawings.
- S. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
  - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
  - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
  - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
  - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

- T. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- U. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- V. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
  - 1. Plain-End Pipe and Fittings: Use butt fusion.
  - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- W. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.
- X. Remake joints which fail pressure tests with new materials including pipe, fittings, gaskets and/or a filler.

### 3.3 ACCESS DOORS

- A. Provide access doors for installation by architectural trades unless noted otherwise. Provide access doors in the walls, as required to make all valves, controls, coils, motors, air vents, filters, electrical boxes and other equipment installed by the Contractor accessible. Minimum size 12 inches x 12 inches. Provide access doors in the ceiling, for accessibility as mentioned above, 24 inches x 24 inches minimum size. Areas with accessible ceilings (ceilings where lay-in panels are not fastened in place and can be individually removed without removal of adjacent tiles) will not require access doors. Refer to Division 08 Section "Access Doors and Frames" for manufacturers and model numbers and additional information.
- B. When access doors are in fire resistant walls or ceilings, they shall bear the Underwriters' Laboratories, Inc., Label, with time design rating equal to or greater than the wall or ceiling unless they were a part of the tested assembly.

### 3.4 EQUIPMENT CONNECTIONS

- A. Make connections to equipment, fixtures, and other items included in the work in accordance with the submittals and rough-in measurements furnished by the manufacturers of the particular equipment furnished.
  - 1. Any and all additional connections not shown on the drawings but shown on the equipment manufacturer's submittal or required for the successful operation of the equipment shall be installed as part of this Contract at no additional charge to the Owner.
- B. All piping connections to pumps, coils, and other equipment shall be installed without strain at the pipe connection of this equipment. When directed, remove the bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected.

### 3.5 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, where indicated on Drawings, at final connection to each piece of equipment and at all control valves.
2. Install flanges, in piping NPS 2-1/2 and larger, where indicated on Drawings, at final connection to each piece of equipment and at all control valves.

### 3.6 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated. Housekeeping pad locations and sizes shall be coordinated by mechanical contractor prior to the placement of concrete slabs.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.
- E. For suspended equipment, furnish and install all inserts, rods, structural steel frames, brackets and platforms required. Obtain approval of Architect for same including loads, locations and methods of attachment.
- F. Equipment Rigging Over Roof Areas: Protect building structure against damage during equipment rigging. Make provisions to distribute load of equipment to main roof structure, and to prevent damage to roof decking, roofing, or purlins.
- G. The Contract Documents indicate items to be purchased and installed. The items are noted by a manufacturer's name, catalog number and/or brief description. The catalog number may not designate all the accessory parts for a particular application. Arrange with the manufacturer for the purchase of all items required for a complete installation.

### 3.7 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified in Division 09.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- C. Where pipe and/or equipment support members must be welded to structural building framing, Contractor shall seek prior approval from Architect and structural engineer. Scrape, brush clean, and apply one coat of zinc rich primer after welding.

- D. Field Welding: Comply with AWS D1.1.

### 3.9 EPOXY BONDING TO EXISTING MATERIALS

- A. Use epoxy bonding compound to set sleeves or pipes in existing concrete to bond new concrete and/or grout to existing materials or to bond dissimilar materials.
- B. The compound, when applied in accordance with the manufacturer's instructions, shall be capable of initial curing within 48 hours at temperatures as low as 40 deg F and shall be capable of bonding any combination of the following properly prepared materials: Wet or dry, cured or uncured concrete or mortar; vitrified clay; cast iron and carbon steel.

### 3.10 JACKING OF PIPE

- A. Do not jack pipe in place except upon prior approval of proposed materials and complete details of methods.

### 3.11 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

### 3.12 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.



### 3.13 CUTTING, CORING AND PATCHING

- A. Refer to Division 01 Specification Sections for requirements for cutting, coring, patching and refinishing work necessary for the installation of mechanical work.
- B. All cutting, coring, patching and repair work shall be performed by the Contractor through approved, qualified subcontractors. Contractor shall include full cost of same in bid.

### 3.14 FLASHING

- A. Provide all flashing required for mechanical work. Refer to Division 07 Specification Sections.

### 3.15 LUBRICATION

- A. Provide all lubrication for the operation of the equipment until acceptance by the Owner. Contractor is responsible for all damage to bearings up to the date of acceptance of the equipment. Protect all bearings and shafts during installation. Thoroughly grease steel shafts to prevent corrosion. Provide covers as required for proper protection of all motors and other equipment during construction.

### 3.16 CLEANING

- A. Each Mechanical Trade shall be responsible for removing all debris daily as required to maintain the work area in a neat, orderly condition.
- B. After equipment, steam, condensate and HVAC water piping systems have been completed and tested, each entire system shall be cleaned and flushed. Refer to Division 23 Section "Piping Systems Flushing and Chemical Cleaning" for requirements. Provide temporary bypass piping and fittings, temporary valves and strainers, temporary water make-up piping with approved means of backflow prevention, and temporary pumps as needed to perform specified flushing and cleaning requirements.
- C. Prior to connection of new HVAC piping to existing HVAC piping systems, all new piping shall be subject to initial flushing, cleaning and final flushing. Refer to Division 23 Section "Piping Systems Flushing and Chemical Cleaning" for requirements. Provide temporary bypass piping and fittings, temporary valves and strainers, temporary water make-up piping with approved means of backflow prevention, and temporary pumps as needed to perform specified flushing and cleaning requirements.
- D. Flushing, cleaning, and disinfection of domestic water piping is specified in Division 22 Section "Domestic Water Piping."

- E. Exterior surfaces of all piping, ductwork and equipment shall be wiped down to remove excess dirt and debris prior to concealment by Architectural Trades work.
- F. Upon completion of work in each respective area, clean and protect work. Just prior to final acceptance, perform additional cleaning as necessary to provide clean equipment and areas to the Owner.

END OF SECTION 200510

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Mechanical Vibration Controls" for mounting motors and vibration isolation devices.
  - 3. Division 20 Section "Variable Frequency Controllers".
  - 4. Division 22, and 23 Sections for application of motors and reference to specific motor requirements for motor-driven equipment.
  - 5. Division 26 Section "Enclosed Switches and Circuit Breakers".
  - 6. Division 26 Section "Enclosed Controllers".
  - 7. Division 26 Section "Fuses".

1.2 SUMMARY

- A. This Section includes basic requirements for factory-installed motors.

### 1.3 DEFINITIONS

- A. ABMA: American Bearing Manufacturers Association. (Formerly AFBMA: Anti-Friction Bearing Manufacturers Association.)
- B. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.
- C. Packaged Self Contained Equipment: Equipment which includes component mechanical and electrical equipment mounted on common bases, skids or frames or in common enclosures with internal control and power wiring factory installed and ready to accept a single electrical service connection. Provide the equipment complete with enclosed controllers, main disconnect switches, control transformers, control devices, wiring and accessories as required.

### 1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: A Nationally Recognized Testing Laboratory (NRTL), acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

### 1.6 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices. Provide motors that are:
  - 1. Compatible with the following:
    - a. Magnetic controllers.
    - b. Multispeed controllers.
    - c. Reduced-voltage controllers.
    - d. Solid-state controllers.
    - e. Variable frequency controllers.
  - 2. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.
  - 3. Matched to torque and horsepower requirements of the load.
  - 4. Matched to ratings and characteristics of supply circuit and required control sequence.

- B. Coordinate electrical scope of work to be provided by Division 20, 22, and 23 with this Section, related Division 20, 22, and 23 Specifications, Division 26 Specifications and the Drawings.
- C. Electrical work provided under Division 20, 22, and 23: Furnish UL Listed components in accordance with this section, Division 26, and applicable NEMA and NEC (ANSI C 1) requirements. Provide wiring, external to electrical enclosures, in conduit.
- D. Furnished, installed and wired under Division 20, 22, and 23 unless otherwise indicated:
  - 1. Disconnected components in packaged self-contained equipment that are so constructed that components of wiring must be disconnected for shipment and reconnected after installation.
- E. Furnished and installed under Division 20, 22, and 23 and wired under Division 26 unless otherwise indicated:
  - 1. Motors required for mechanical equipment
  - 2. Packaged Self-Contained Equipment:
    - a. Provide equipment ready to accept a single electrical service connection.
    - b. For equipment with remote mounted control panels, provide mounting of the control panel and external wiring from the control panel to the package self-contained equipment.
  - 3. Variable frequency controllers.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
  - 1. Dayton.
  - 2. Toshiba Intl.
  - 3. Baldor Electric/Reliance.
  - 4. Nidec Motor Corporation; U.S. Electrical Motors.
  - 5. Regal Beloit/GE Commercial Motors.
  - 6. Regal Beloit/Leeson.
  - 7. Regal Beloit/Marathon.
  - 8. Siemens.

### 2.2 MOTOR REQUIREMENTS

- A. Motor requirements apply to factory-installed and field-installed motors except as follows:
  - 1. Different ratings, performance, or characteristics for a motor are specified in another Section.

2. Manufacturer for a factory-installed motor requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.
  3. Submersible motors integral to pumps and excluded from NEMA and EISA standards.
- B. Electrical Power Supply Characteristics: Coordinate electrical system requirements with Division 26.
- C. Electrical Power System Characteristics: As scheduled on the Drawings.
- D. Electrical Connection: Conduit connection boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide screwed conduit connection in end frame.

### 2.3 MOTOR CHARACTERISTICS

- A. Motors 1/2 HP and Larger: Three phase, unless otherwise indicated.
- B. Motors Smaller Than 1/2 HP: Single phase, unless otherwise indicated.
- C. Frequency Rating: 60 Hz.
- D. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
- E. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
- F. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
- G. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- H. Brake Horsepower Input: Shall not exceed 90 percent of the rated motor horsepower.
- I. Enclosure: Open dripproof (ODP) for motors installed indoors and out of the airstream. Totally-enclosed fan-cooled (TEFC) for motors installed outdoors or within the airstream.

### 2.4 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Fire pump motors, C-face motors, JP and JM frame motors, and motors over 200 horsepower shall be energy efficient motors. Efficiency of the motor shall be determined based on the NEMA MG1. The minimum efficiencies, nominal efficiencies and shall meet or exceed Table 12-11.

HP	1800 RPM OPEN DRIP-PROOF MOTORS 4 POLE		1800 RPM ENCLOSED MOTORS 4 POLE	
	NOMINAL	MINIMUM	NOMINAL	MINIMUM
	EFF	EFF	EFF	EFF
1	82.5	81.5	82.5	81.5
1.5	84	82.5	84	82.5
2	84	82.5	84	82.5
3	86.5	85.5	87.5	86.5
5	87.5	86.5	87.5	86.5
7.5	88.5	87.5	89.5	88.5
10	89.5	88.5	89.5	88.5
15	91	90.2	91	90.2
20	91	90.2	91	90.2
25	91.7	91	92.4	91.7
30	92.4	91.7	92.4	91.7
40	93	92.4	93	92.4
50	93	92.4	93	93
60	93.6	93	93.6	93
75	94.1	93.6	94.1	93.6
100	94.1	93.6	94.5	94.1
125	94.5	94.1	94.5	94.1
150	95	94.5	95	94.5
200	95	94.5	95	94.5

HP	1200 RPM OPEN DRIP-PROOF MOTORS 6 POLE		3600 RPM OPEN DRIPPROOF MOTORS 2 POLE	
	NOMINAL	MINIMUM	NOMINAL	MINIMUM
	EFF	EFF	EFF	EFF
1	80	78.5	--	--
1.5	84	82.5	82.5	81.5
2	85.5	84	84	82.5
3	86.5	85.5	84	82.5
5	87.5	86.5	85.5	84
7.5	88.5	87.5	85.5	86.5
10	90.2	89.5	88.5	87.5
15	90.2	89.5	89.5	88.5
20	91	90.2	90.2	89.5
25	91.7	91	91	90.2
30	92.4	91.7	91	90.2
40	93	92.4	91.7	91
50	93	93	92.4	91.7
60	93.6	93	93	92.4
75	93.6	93	93	92.4
100	94.1	93.6	93	92.4
125	94.1	93.6	93.6	93
150	94.5	94.1	93.6	93
200	94.5	94.1	94.5	94.1

C. Efficiency: Motors 1 horsepower to 200 horsepower shall be premium efficient motors meeting requirements of NEMA Premium Efficiency Motor Program.

Efficiency of the motor shall be determined based on the NEMA MG1. The nominal efficiencies shall meet or exceed Table 12-12.

Nominal Efficiencies For "NEMA Premium™" Induction Motors  
 Rated 600 Volts or Less (Random Wound)

HP	Open Drip-Proof			Totally Enclosed Fan-Cooled		
	6-pole	4-pole	2-pole	6-pole	4-pole	2-pole
1	82.5	85.5	77.0	82.5	85.5	77.0
1.5	86.5	86.5	84.0	87.5	86.5	84.0
2	87.5	86.5	85.5	88.5	86.5	85.5
3	88.5	89.5	85.5	89.5	89.5	86.5
5	89.5	89.5	86.5	89.5	89.5	88.5
7.5	90.2	91.0	88.5	91.0	91.7	89.5
10	91.7	91.7	89.5	91.0	91.7	90.2
15	91.7	93.0	90.2	91.7	92.4	91.0
20	92.4	93.0	91.0	91.7	93.0	91.0
25	93.0	93.6	91.7	93.0	93.6	91.7
30	93.6	94.1	91.7	93.0	93.6	91.7
40	94.1	94.1	92.4	94.1	94.1	92.4
50	94.1	94.5	93.0	94.1	94.5	93.0
60	94.5	95.0	93.6	94.5	95.0	93.6
75	94.5	95.0	93.6	94.5	95.4	93.6
100	95.0	95.4	93.6	95.0	95.4	94.1
125	95.0	95.4	94.1	95.0	95.4	95.0
150	95.4	95.8	94.1	95.8	95.8	95.0
200	95.4	95.8	95.0	95.8	96.2	95.4

Nominal Efficiencies For "NEMA Premium™" Induction Motors  
 Rated Medium Volts for 5kV or Less (Form Wound)

HP	Open Drip-Proof			Totally Enclosed Fan-Cooled		
	6-pole	4-pole	2-pole	6-pole	4-pole	2-pole
250	95.0	95.0	94.5	95.0	95.0	95.0
300	95.0	95.0	94.5	95.0	95.0	95.0
350	95.0	95.0	94.5	95.0	95.0	95.0
400	95.0	95.0	94.5	95.0	95.0	95.0
450	95.0	95.0	94.5	95.0	95.0	95.0
500	95.0	95.0	94.5	95.0	95.0	95.0

- D. Stator: Copper windings, unless otherwise indicated.
  - 1. Multispeed motors shall have separate winding for each speed.
- E. Rotor: Squirrel cage, unless otherwise indicated.
- F. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 120,000 hours. Calculate bearing load with NEMA minimum V- belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
- G. Temperature Rise: Match insulation rating, unless otherwise indicated.



- H. Insulation: Class F, unless otherwise indicated.
- I. Code Letter Designation:
  - 1. Motors 10 HP and Larger: NEMA starting Code (KVA Code) F or G.
  - 2. Motors Smaller Than 10 HP: Manufacturer's standard starting characteristic.
  - 3. Fire Pump Motors: NEMA starting Code (KVA Code) B.
- J. Enclosure: Cast iron for motors 7.5 hp and larger; rolled steel for motors smaller than 7.5 hp.
  - 1. Finish: Gray enamel.
- K. Sound Level: Not to exceed NEMA MG-1 12.54.

## 2.5 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
  - 2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
- C. Shaft Grounding: Provide a means to protect motor from common mode currents.
  - 1. Required for:
    - a. Motors used with variable frequency controllers.
    - b. Motors 100 HP and larger.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Electro Static Technology, Inc.; Aegis SGR Conductive Microfiber.
- D. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:
  - 1. Measure winding resistance.
  - 2. Read no-load current and speed at rated voltage and frequency.
  - 3. Measure locked rotor current at rated frequency.
  - 4. Perform high-potential test.

## 2.6 SINGLE-PHASE MOTORS

- A. Type: One of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent-split capacitor.
  - 2. Split-phase start, capacitor run.
  - 3. Capacitor start, capacitor run.
- B. Shaded-Pole Motors: For motors 1/20 hp and smaller only.
- C. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.
- D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, prelubricated-sleeve type for other single-phase motors.

## 2.7 ENCLOSED CONTROLLERS

- A. Provide enclosed controllers in accordance with requirements specified in Division 26 Section "Enclosed Controllers".

## 2.8 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

- A. Provide enclosed switches and circuit breakers in accordance with requirements specified in Division 26 Section "Enclosed Switches and Circuit Breakers".

## 2.9 FUSES

- A. Provide fuses in accordance with requirements specified in Division 26 Section "Fuses".

## PART 3 - EXECUTION

### 3.1 FIELD QUALITY CONTROL

- A. All three phase motors 1/2 HP and above shall be tested by the Testing Agency.
- B. Prepare for acceptance tests as follows:
  - 1. Check motor nameplates for horsepower, speed, phase and voltage.
  - 2. Check coupling alignment and shaft end play.
  - 3. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
  - 4. Test interlocks and control features for proper operation.
  - 5. Verify that current in each phase is within nameplate rating.

C. Testing: Perform the following field quality-control testing:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.15.1. Certify compliance with test parameters.
2. Jog motor as required to verify proper phase and shaft rotation. Immediately after start-up, check bearing temperature and smooth operation. Take current reading at full load using a clamp-on ammeter. If ammeter reading is over the rated full load current, determine reason for discrepancy and take necessary corrective actions. Record all readings, motor nameplate data and overload heater data.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.2 ADJUSTING

- A. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

3.3 CLEANING

- A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean motors, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 200513

SECTION 200516 - PIPE FLEXIBLE CONNECTORS, EXPANSION FITTINGS AND LOOPS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 23 Section "Refrigerant Piping."

1.2 DEFINITIONS

- A. BR: Butyl rubber.
- B. CR: Chlorosulfonated polyethylene synthetic rubber (Neoprene).
- C. CSM: Chlorosulfonyl-polyethylene rubber (Hypalon).
- D. EPDM: Ethylene-propylene-diene terpolymer rubber.
- E. NBR: Buna-N/Nitrile rubber.
- F. NR: Natural rubber.
- G. PTFE: Polytetrafluoroethylene plastic.

### 1.3 PERFORMANCE REQUIREMENTS

- A. Compatibility: Products shall be suitable for piping system fluids, materials, working pressures, and temperatures.
- B. Capability: Products shall absorb 150 percent of maximum axial movement between anchors.

### 1.4 SUBMITTALS

- A. Product Data: For each type of pipe flexible connector, expansion joint and alignment guide indicated.
- B. Delegated-Design Submittal:
  - 1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
  - 2. Locations of pipe anchors and alignment guides and expansion joints and loops.
- C. Shop Drawings: Signed and sealed by a qualified professional engineer.
  - 1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and bends.
  - 2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
  - 3. Alignment Guide Details: Detail field assembly and attachment to building structure.
  - 4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.
- D. Product Certificates: For each type of pipe expansion joint, signed by product manufacturer.
- E. Welding certificates.
- F. Operation and Maintenance Data: For pipe expansion joints to include in operation and maintenance manuals.

### 1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
  - 1. Steel Shapes and Plates: AWS D1.1, "Structural Welding Code - Steel."
  - 2. Welding to Piping: ASME Boiler and Pressure Vessel Code: Section IX.
- B. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," and NSF 372 Drinking Water System Components - Lead Content for potable domestic water piping and components.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 FLEXIBLE CONNECTORS

- A. Hose and Braid Flexible Connectors:
1. Manufacturers:
    - a. Adscos Manufacturing, LLC.
    - b. Flex-Weld, Inc.
    - c. Hyspan Precision Products, Inc.
    - d. Metraflex, Inc.
    - e. Senior Flexonics, Inc.; Pathway Division.
    - f. Twin City Hose, Inc.
  2. Flexible Connectors for Copper Piping: Multiple-ply phosphor-bronze corrugated hose with bronze outer braid, copper ferrule, and copper pipe end connections.
  3. Flexible Connectors for Steel Piping: Multiple-ply stainless-steel corrugated hose with stainless steel outer braid, and steel pipe end connections.
  4. Minimum Pressure Rating: 150 psig, unless otherwise indicated.
  5. Maximum Temperature Rating: 450 deg F for copper piping connectors, 800 deg F for steel piping connectors.

### 2.3 EXPANSION JOINTS

- A. Metal-Bellows Expansion Joints: ASTM F 1120, circular-corrugated-bellows type.
1. Manufacturers:
    - a. Adscos Manufacturing, LLC.
    - b. Flex-Weld, Inc./Keflex.
    - c. Hyspan Precision Products, Inc.
    - d. Metraflex, Inc.
    - e. Senior Flexonics, Inc.; Pathway Division.
    - f. Twin City Hose, Inc.
  2. Metal-Bellows Expansion Joints for Stainless-Steel Waterway: Single-ply stainless-steel bellows, stainless-steel-pipe end connections.
  3. Metal-Bellows Expansion Joints for Steel Piping: Single- or multiple-ply stainless-steel bellows, and steel pipe end connections.
  4. Minimum Pressure Rating: 200 psig, unless otherwise indicated.
  5. Maximum Temperature Rating: 650 deg F.
  6. Configuration: Single- or double -bellows type with base, unless otherwise indicated.

7. End Connections: Threaded, Flanged or weld.
- B. Externally Pressurized Metal-Bellows Expansion Joints: ASTM F 1120, circular-corrugated-bellows type with removable shipping bar.
1. Manufacturers:
    - a. Adscos Manufacturing, LLC.
    - b. Flex-Weld, Inc./Keflex.
    - c. Hyspan Precision Products, Inc.
    - d. Metraflex, Inc.
    - e. Senior Flexonics, Inc.; Pathway Division.
    - f. Twin City Hose, Inc.
  2. Metal-Bellows Expansion Joints for Steel Piping: Multiple-ply or laminated stainless-steel bellows, steel pipe end connections, internal guide ring and stop, and carbon-steel shroud with drain plug.
  3. Minimum Pressure Rating: 200 psig, unless otherwise indicated.
  4. Maximum Temperature Rating: 750 deg F.
  5. Configuration: Single- or double -bellows type with base, unless otherwise indicated.
  6. End Connections: Flanged or weld.
- C. Expansion Compensators: Double-ply corrugated steel, stainless-steel, or copper-alloy bellows in a housing with internal guides, antitorque device, and removable end clip for positioning.
1. Manufacturers:
    - a. Adscos Manufacturing, LLC.
    - b. Flex-Weld, Inc./Keflex.
    - c. Hyspan Precision Products, Inc.
    - d. Metraflex, Inc.
    - e. Senior Flexonics, Inc.; Pathway Division.
    - f. Twin City Hose, Inc.
  2. Minimum Pressure Rating: 200 psig, unless otherwise indicated.
  3. Configuration for Copper Piping: Two-ply stainless-steel bellows and bronze or stainless-steel shroud.
  4. Configuration for Steel Piping: Two-ply stainless-steel bellows and carbon-steel shroud.
  5. End Connections for Copper Tubing NPS 2 and Smaller: Solder joint.
  6. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: Solder joint.
  7. End Connections for Steel Pipe NPS 2 and Smaller: Threaded.
  8. End Connections for Steel Pipe NPS 2-1/2 to NPS 4: Flanged or Weld.
- D. Flexible-Hose Expansion Joints: Manufactured assembly with two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose; with inlet and outlet elbow fittings, corrugated-metal inner hoses, and braided outer sheaths.
1. Manufacturers:
    - a. Flex-Hose Co., Inc.
    - b. Metraflex, Inc.; Metraloop.
    - c. Twin City Hose, Inc.

2. Flexible-Hose Expansion Joints for Copper Piping: Copper-alloy fittings with solder- or brazed- joint end connections.
  - a. NPS 2 and Smaller: Bronze hoses and single-braid bronze sheaths with minimum 300 psig at 70 deg F and 230 psig at 400 deg F ratings.
  - b. NPS 2-1/2 to NPS 4: Stainless-steel hoses and single-braid, stainless-steel sheaths with minimum 230 psig at 70 deg F and 180 psig at 400 deg F ratings.
3. Flexible-Hose Expansion Joints for Steel Piping: Carbon-steel fittings with threaded end connections for NPS 2 and smaller and flanged or weld end connections to match piping system for NPS 2-1/2 and larger.
  - a. NPS 2 and Smaller: Stainless-steel hoses and single-braid, stainless-steel sheaths with minimum 450 psig at 70 deg F and 325 psig at 600 deg F ratings; and 300 psig maximum saturated steam pressure rating.
  - b. NPS 2-1/2 to NPS 6: Stainless-steel hoses and single-braid, stainless-steel sheaths with minimum 165 psig at 70 deg F and 120 psig at 600 deg F ratings; and 130 psig maximum saturated steam pressure rating.
  - c. NPS 8 to NPS 12: Stainless-steel hoses and single-braid, stainless-steel sheaths with minimum 160 psig at 70 deg F and 115 psig at 600 deg F ratings; and 90 psig maximum saturated steam pressure rating.
- E. Packed Slip Expansion Joints: ASTM F 1007, carbon-steel, packing type designed for repacking under pressure and pressure rated for 250 psig at 400 deg F minimum. Include asbestos-free PTFE packing compound, limit stops, and drip connection if used for steam piping.
  1. Manufacturers:
    - a. Adscos Manufacturing, LLC.
    - b. Advanced Thermal Systems, Inc.
    - c. Hyspan Precision Products, Inc.
    - d. Tyco Flow Control; Yarway.
  2. Configuration: Single- and double-joint class with base, unless otherwise indicated.
  3. End Connections: Flanged or weld ends to match piping system.
- F. Flexible Ball Joints: Carbon-steel assembly with asbestos-free composition packing, designed for 360-degree rotation and angular deflection, and 250 psig at 400 deg F minimum pressure rating; complying with ASME Boiler and Pressure Vessel Code: Section II, "Materials," and with ASME B31.9, "Building Services Piping," for materials and design of pressure-containing parts and bolting.
  1. Manufacturers:
    - a. Advanced Thermal Systems, Inc.
    - b. Hyspan Precision Products, Inc.; Barco.
  2. Angular Deflection for NPS 6 and Smaller: 30-degree minimum.
  3. Angular Deflection for NPS 8 and Larger: 15-degree minimum.
  4. End Connections for NPS 2 and Smaller: Threaded.
  5. End Connections for NPS 2-1/2 and Larger: Flanged.



## 2.4 ALIGNMENT GUIDES

- A. Description: Steel, factory fabricated, with bolted two-section outer cylinder and base for alignment of piping and two-section guiding spider for bolting to pipe.
1. Manufacturers:
    - a. Adscos Manufacturing, LLC.
    - b. Flex-Weld, Inc.
    - c. Hyspan Precision Products, Inc.
    - d. Metraflex, Inc.
    - e. Senior Flexonics, Inc.; Pathway Division.

## 2.5 SLIDING/GUIDING DEVICES

- A. For pipe size 4 inch and smaller on all hot piping, provide guides equal to Flexonics semi-steel spider and guiding cylinder pipe alignment guides for all expansion joints and loops. Provide pipe alignment guides in quantities at all locations as required according to the manufacturer's design criteria and recommendations. Pipe alignment guides shall serve to guide the expansion joints, loops or bends.
1. Manufacturers:
    - a. B-Line by Eaton; Figure 3281 Series.
    - b. Senior Flexonics.
    - c. Sypris Technologies; Tube Turns Division;
    - d. U.S. Flexible Metallic Tubing Co., Kelflex Type M.
    - e. Metraflex, Inc.
  
  - B. For pipe sizes 6 inches and above and all guides on cold piping, furnish pre-engineered pre-insulated guides with published vertical and lateral load ratings. Construction shall consist of an insulated shield containing structural calcium silicate (100 psi non-load bearing and 600 psi load bearing) encased in 360 degrees of overlapping sheet metal. A 36 steel clamps torqued onto insulated shield with recommended catalog torque values. Slide service shall be stainless steel to polyethylene or Teflon with a maximum coefficient of friction of 0.15.
    1. Manufacturers:
      - a. Pipe Shields, Inc. B3000, B4000, B7000 and B8000 series.
      - b. Carpenter and Paterson, Inc.
      - c. Rilco Mfg. HG 3000, HG 4000, HG 7000, and HG 8000 series.

## 2.6 MATERIALS FOR ANCHORS

- A. Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex head.
- C. Washers: ASTM F 844, steel, plain, flat washers.
- D. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, and tension and shear capacities appropriate for application.

1. Stud: Threaded, zinc-coated carbon steel.
  2. Expansion Plug: Zinc-coated steel.
  3. Washer and Nut: Zinc-coated steel.
- E. Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened portland cement concrete, and tension and shear capacities appropriate for application.
1. Bonding Material: ASTM C 881, Type IV, Grade 3, 2-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
  2. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
  3. Washer and Nut: Zinc-coated steel.
- F. Concrete: Portland cement mix, 3000 psi minimum. Refer to Division 03 Section "Cast-in-Place Concrete" for formwork, reinforcement, and concrete.
- G. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink, nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
  2. Design Mix: 5000-psi, 28-day compressive strength.

### PART 3 - EXECUTION

#### 3.1 FLEXIBLE CONNECTOR APPLICATIONS

- A. Use hose and braid flexible pipe connectors at the inlet and outlet water connections of base mounted pumps, chillers, and cooling towers, unless otherwise indicated.
1. Flexible Connectors: Stainless steel hose and braid style with threaded end connections for pipe sized NPS 2 and smaller.
  2. Flexible Connectors: Stainless steel hose and braid style with steel flange end connections for pipe sized NPS 2-1/2 and larger.

#### 3.2 EXPANSION-JOINT INSTALLATION

- A. Install manufactured, nonmetallic expansion joints according to FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
- B. Install expansion joints of sizes matching size of piping in which they are installed.
- C. Install alignment guides to allow expansion and to avoid end-loading and torsional stress.
- D. Install alignment guides at spacing recommended by expansion joint manufacturer.

- E. Control expansion joint movement by installing two rigid pipe guides on each side of the expansion joint. Spacing shall be as follows:

Nom. Pipe Size  (In.)	Exp. Joint to 1st Guide	1st to 2nd Guide	Maximum Distance Between Intermediate Guides (Ft.) For Tabulated pressures, PSIG							
			50	100	150	200	250	300	350	400
1	0'-4"	1'-4"	21	15	12					
1 1/4	0'-5"	1'-5"	23	17	13					
1 1/2	0'-6"	1'-9"	28	20	17					
2	0'-8"	2'-4"	32	23	18					
2 1/2	0'-10"	2'-11"	35	28	22					
3	1'-0"	3'-6"	21	19	17	16	15	14	13	13
4	1'-4"	4'-8"	35	29	25	22	20	19	18	17
6	2'-0"	7'-0"	57	44	37	32	29	27	25	23
8	2'-8"	9'-4"	66	52	45	40	36	33	31	29
10	3'-4"	11'-8"	91	69	58	51	46	42	39	36
12	4'-0"	14'-0"	107	79	66	58	52	48	44	41
14	4'-8"	16'-4"	115	85	71	62	56	51	47	
16	5'-4"	18'-8"	127	94	78	68	61	56	52	
18	6'-0"	21'-0"	139	102	85	74	67	61	56	
20	6'-8"	23'-4"	151	110	91	80	71			
24	8'-0"	28'-0"	172	125	103	89	80			
30	10'-0"	35'-0"	200	144	118	103	92			

### 3.3 PIPE BEND AND LOOP INSTALLATION

- A. Install pipe bends and loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
- B. Attach pipe bends and loops to anchors.
1. Steel Anchors: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  2. Concrete Anchors: Attach by fasteners. Follow fastener manufacturer's written instructions.

### 3.4 SWING CONNECTIONS

- A. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.
- B. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.
- C. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

### 3.5 ALIGNMENT-GUIDE INSTALLATION

- A. Install guides on piping adjoining pipe expansion joints and bends and loops.
- B. Attach guides to pipe and secure to building structure.

### 3.6 ANCHOR INSTALLATION

- A. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.
- C. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.
- D. Install pipe anchors according to expansion-joint manufacturer's written instructions if expansion joints or compensators are indicated.
- E. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.

END OF SECTION 200516

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 22 Section "Water Distribution" for domestic and fire-protection water service meters outside the building.
  - 4. Division 22 Section "Domestic Water Piping" for domestic water service meters inside the building.
  - 5. Division 23 Section "Fuel Gas Piping" for gas utility meters.

1.2 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. FPR: Fiberglass reinforced plastic.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated; include performance curves.

- B. Shop Drawings: Schedule for the following indicating manufacturer's number, scale range, and location for each:
  - 1. Thermometers.
  - 2. Gages.
  - 3. Flow measuring devices.

#### 1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," and NSF 372 Drinking Water System Components - Lead Content for potable domestic water piping and components.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

#### 2.2 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

- A. Manufacturers:
  - 1. AMETEK, Inc.; U.S. Gauge Div.
  - 2. Miljoco Corporation.
  - 3. REOTEMP Instrument Corporation.
  - 4. Trerice, H. O. Co.
  - 5. Weiss Instruments, Inc.
  - 6. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Case: Die-cast aluminum or Chrome-plated brass, 9 inches long.
- C. Tube: Red, blue, or green reading, organic-liquid filled, with magnifying lens.
- D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- E. Window: Glass or plastic.
- F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.

- H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

### 2.3 PLASTIC-CASE, LIQUID-IN-GLASS THERMOMETERS

- A. Manufacturers:
  - 1. AMETEK, Inc.; U.S. Gauge Div.
  - 2. Marsh Bellofram.
  - 3. Miljoco Corp.
  - 4. REOTEMP Instrument Corporation.
  - 5. Terrice, H. O. Co.
  - 6. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Case: Plastic, 9 inches long.
- C. Tube: Red, blue, or green reading, organic-liquid filled, with magnifying lens.
- D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- E. Window: Glass or plastic.
- F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- G. Stem: Metal, for thermowell installation and of length to suit installation.
- H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

### 2.4 THERMOWELLS

- A. Manufacturers: Same as manufacturer of thermometer being used.
- B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer. Brass for compatible services less than 353 degrees F; ANSI 18-8 stainless steel for all others to suit service. Furnish extension neck to accommodate insulation where applicable.

### 2.5 PRESSURE GAGES

- A. Manufacturers:
  - 1. AMETEK, Inc.; U.S. Gauge Div.
  - 2. Cambridge.
  - 3. Dwyer Instruments, Inc.
  - 4. Marsh Bellofram.
  - 5. Miljoco Corporation.
  - 6. Terrice, H. O. Co.
  - 7. Weiss Instruments, Inc.
  - 8. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

- B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
1. Case: Stainless steel, aluminum, or FRP, minimum 4-1/2-inch diameter.
  2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
  3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
  4. Movement: Mechanical, with link to pressure element and connection to pointer.
  5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
  6. Pointer: Red or other dark-color metal.
  7. Window: Glass or plastic.
  8. Ring: Stainless steel or chrome plated metal.
  9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
  10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
  11. Water: 0-100 PSIG (1 psi divisions to 50 psi; 5 psi divisions above 50 psi), liquid filled.
  12. Range for Fluids under Pressure: 1-1/2 times expected working pressure. If not a standard scale, select next largest scale.
- C. Pressure-Gage Fittings:
1. Valves: NPS 1/4 brass ball type.
  2. Syphons: NPS 1/4 coil of brass tubing with threaded ends.
  3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

## 2.6 TEST PLUGS

- A. Manufacturers:
1. Peterson Equipment Co., Inc.
  2. Miljoco Corporation.
- B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.
- C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F for cold services, and 500 psig at 275 deg F for hot services.
- D. Core Inserts: One or two self-sealing rubber valves.
1. Insert material for air, water, oil, or gas service at 20 to 200 deg F shall be Neoprene.
  2. Insert material for air or water service at minus 30 to plus 275 deg F shall be Nordel.
- E. Test Kit: Furnish test kit(s) containing one pressure gage and adaptor, thermometer(s), and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.



1. Pressure Gage: Small bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be 0 to 200 psig.
2. Low-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial ranges shall be 25 to 125 deg F.
3. High-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 deg F.
4. Carrying case shall have formed instrument padding.

## 2.7 FLOW MEASURING DEVICES

### A. Manufacturers:

1. Dietrich Standard Subsidiary of Rosemount Division of Emerson Process Management; Diamond II - Flo-Tap Model.
2. Preso Meters Corporation.
3. Taco, Inc.

B. Flow measuring device shall be used where indicated on the drawings and in sizes NPS 6 and larger and shall be annular primary flow elements. The annular primary flow elements shall be type 316, stainless steel, diamond shape or elliptical shape in cross-section. Pressure rating shall meet or exceed system minimum pressure rating as indicated for each system. Provide permanent, rust-proof metal identification tag on a chain indicating design flow rates, metered fluid and line size. Flow measuring devices shall be weld insert type. Units shall be capable of being inserted without system shut-down.

C. Accuracy shall be plus or minus 1 percent over a flow turndown at least 10 to 1, independent of Reynold's number. Repeatability shall be plus or minus 0.1 percent.

D. Sensors shall be installed in strict accordance with the manufacturer's recommendations with special attention given to alignment and straight run requirements.

E. Flow measuring device in chilled water system de-coupler pipe shall have bi-directional flow measurement capability, or two uni-directional devices shall be provided.

F. Flow gages which read in actual GPM shall be provided for all flow measuring devices on pumps 200 GPM or larger, and for both flow directions on the chilled water system de-coupler pipe flow measuring device. Gage scale shall be linear to flow. Maximum flow rate on scale shall be selected at 120 percent of the pump's scheduled flow rate (120 percent of the scheduled flow rate of one chiller for the chilled water system de-coupler). Gage scale shall be 2.5 inch x 6 inch minimum, or 4 inch diameter minimum, and shall be mounted at eye level on unistrut support.

## PART 3 - EXECUTION

### 3.1 THERMOMETER APPLICATIONS

A. Install liquid-in-glass thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler and chiller.
3. Inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
4. Inlet and outlet of each hydronic heat exchanger.
5. Inlet and outlet of each hydronic heat-recovery unit.
6. Outside-air, return-air, and mixed-air ducts.

B. Provide the following temperature ranges for thermometers:

1. Domestic Hot Water: 30 to 180 deg F, with 2-degree scale divisions.
2. Domestic Cold Water: 30 to 130 deg F, with 2-degree scale divisions.
3. Heating Hot Water: 30 to 240 deg F, with 2-degree scale divisions.
4. Chilled Water: 0 to 100 deg F, with 2-degree scale divisions.
5. Air Ducts: Minus 40 to plus 110 deg F, with 2-degree scale divisions.

### 3.2 GAGE APPLICATIONS

- A. Install dry-case-type pressure gages on inlet and outlet of each pressure-reducing valve.
- B. Install liquid-filled-case-type pressure gages at chilled- and condenser-water inlets and outlets of chillers.
- C. Install liquid-filled-case-type pressure gages at suction and discharge of each pump.

### 3.3 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.
- C. Duct Thermometer Support Flanges: Install in wall of duct where duct thermometers are indicated. Attach to duct with screws.
- D. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- E. Install ball valve and snubber fitting in piping for each pressure gage for fluids.
- F. Install test plugs in tees in piping.
- G. Install connection fittings for attachment to portable indicators in accessible locations.

### 3.4 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

3.5 ADJUSTING

- A. Calibrate meters according to manufacturer's written instructions, after installation.
- B. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 200519

SECTION 200529 - HANGERS AND SUPPORTS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
  - 2. Division 21 Section "Fire-Suppression Piping" for pipe hangers for fire-protection piping.
  - 3. Division 20 Section "Mechanical General Requirements."
  - 4. Division 20 Section "Basic Mechanical Materials and Methods."
  - 5. Division 20 Section "Mechanical Vibration Controls" for vibration isolation devices.
  - 6. Division 20 Section "Pipe Expansion Fittings and Loops" for pipe guides and anchors.
  - 7. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

## 1.2 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. MFMA: Metal Framing Manufacturers Association.

## 1.3 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

## 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Steel pipe hangers and supports.
  - 2. Thermal-hanger shield inserts.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
  - 1. Trapeze pipe hangers. Include Product Data for components.
  - 2. Metal framing systems. Include Product Data for components.
  - 3. Pipe stands. Include Product Data for components.
  - 4. Equipment supports.
- C. Welding certificates.

## 1.5 QUALITY ASSURANCE

- A. MSS Standards: Pipe hangers, supports, and accessories shall comply with the following:
  - 1. MSS SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.
  - 2. MSS SP-69, Pipe Hangers and Supports - Selection and Application.
  - 3. MSS SP-89, Pipe Hangers and Supports - Fabrication and Installation Practices.
- B. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code--Steel."
  - 2. AWS D1.2, "Structural Welding Code--Aluminum."
  - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
  - 4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
  - 5. ASME Boiler and Pressure Vessel Code: Section IX.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 HANGER ROD MATERIAL

- A. Threaded, hot rolled, steel rod conforming to ASTM A 36 or A575.
  - 1. Rod continuously threaded.
  - 2. Use of rod couplings is prohibited.

### 2.3 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-69, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article, and schedules and details on the Drawings for where to use specific hanger and support types.
  - 1. Hangers and Supports for Fire Protection Piping: UL listed or FMG approved.
- B. Manufacturers:
  - 1. Anvil International, Inc.
  - 2. B-Line by Eaton.
  - 3. Carpenter & Paterson, Inc.
  - 4. Hilti USA.
  - 5. Pentair Electrical & Fastening Solutions; CADDY.
  - 6. PHD Manufacturing, Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

### 2.4 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

### 2.5 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

- B. Manufacturers:
  - 1. Anvil International, Inc.; Anvil-Strut.
  - 2. B-Line by Eaton.
  - 3. Power-Strut; a part of Atkore International.
  - 4. Unistrut; a part of Atkore International.
  - 5. Hilti USA.
- C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- D. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- E. Nonmetallic Coatings: Plastic coating, jacket, or liner.

## 2.6 METAL INSULATION SHIELDS

- A. Manufacturers:
  - 1. Anvil International, Inc.
  - 2. B-Line by Eaton.
  - 3. Carpenter & Paterson, Inc.
  - 4. Pentair Electrical & Fastening Solutions; CADDY.
  - 5. PHD Manufacturing, Inc.
- B. Description: MSS SP-69, Type 40, protective shields. Shields shall span an arc of 180 degrees.
- C. Shield Dimensions for Pipe: Not less than the following:
  - 1. NPS 1/4 to NPS 2: 12 inches long and 0.048 inch thick.

## 2.7 PIPE COVERING PROTECTION SADDLES

- A. Manufacturers:
  - 1. Anvil International, Inc.
  - 2. B-Line by Eaton.
  - 3. Carpenter & Paterson, Inc.
  - 4. Pentair Electrical & Fastening Solutions; CADDY.
  - 5. PHD Manufacturing, Inc.
- B. Description: MSS SP-69, Type 39A and Type 39B, for suspension of insulated hot pipe where heat losses are to be kept to a minimum.
  - 1. Saddles shall match insulation thickness.
  - 2. Saddle length: 12 inches.
  - 3. Furnish with center rib for pipe sized NPS 12 and larger.

## 2.8 PLASTIC INSULATION SHIELDS

- A. Manufacturers:
  - 1. B-Line by Eaton; Snap'N Shield.

2. Hydra-Zorb Company; Bronco.
- B. Description: Polypropylene copolymer protective shields designed to snap directly onto strut channel. Shields shall span an arc of 180 degrees.
  1. Operating Temperature Range: Minus 40 deg F to plus 178 deg F.
- C. Certifications:
  1. UL Classified for USA: UL-723 (ASTM E 84).
  2. UL listed for Canada: ULC-S102.2.
  3. Meets UL94 HB flammability standards.
- D. Shield Dimensions for Pipe: Not less than the following:
  1. NPS 1/4 to NPS 2: 12 inches long.

## 2.9 THERMAL-HANGER SHIELDS

- A. Manufacturers:
  1. American Mechanical Insulation Sales Inc. (AMIS).
  2. B-Line by Eaton.
  3. Pentair Electrical & Fastening Solutions; CADDY.
  4. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
  5. Rilco Manufacturing Company, Inc.
  6. Value Engineered Products, Inc.
- B. Description: Manufactured assembly consisting of insulation insert encased in 360 degree sheet metal shield.
  1. Minimum Compressive Strength of Insert Material:
    - a. 100-psig- for sizes smaller than NPS 6.
    - b. 600-psig- for sizes NPS 6 and larger.
- C. Insulation-Insert Material for Cold Piping: Full 360 degree, water-repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Full 360 degree, water-repellent treated, ASTM C 533, Type I calcium silicate.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.
- F. Include carbon steel ASTM A36 load distribution plates as required by load, pipe movement, hanger style, and hanger spacing.
- G. Thermal-Hanger Shields for Flexible Foamed Elastomeric Insulated Piping:
  1. Manufacturer:
    - a. B-Line by Eaton/Armacell; Armafix IPH.



2. Insulation-Insert Material for Copper Piping with Flexible Foamed Elastomeric Insulation: Use the following:

- a. Flexible foamed elastomeric, ASTM 534, Type I-Tubular Grade 1 with PUR/PIP support inserts.

- H. Thermal-Hanger Shields for Small Diameter Piping:

1. Manufacturer:

- a. Hydra-Zorb Company; Klo-Shure Insulation Couplings.

2. Insulation-Insert Material for Small Diameter Piping with Flexible Foamed Elastomeric or Glass Fiber Insulation: Use the following:

- a. Rigid Hytrel thermoplastic insulation coupling designed for use with pipe or tube NPS 4 and smaller, and insulation from 3/8 inch to 1-1/2 inch thick.

## 2.10 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

- a. B-Line by Eaton.
- b. Empire Industries, Inc.
- c. Hilti, Inc.
- d. ITW Ramset/Red Head.
- e. MKT Fastening, LLC.
- f. Powers Fasteners.

- B. Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened portland cement concrete, and tension and shear capacities appropriate for application. Exception: Do not use chemical fasteners to support hanger systems for fire protection piping.

1. Manufacturers:

- a. Hilti, Inc.
- b. ITW Ramset/Red Head.
- c. MKT Fastening, LLC.
- d. Powers Fasteners.

2. Bonding Material: ASTM C 881, Type IV, Grade 3, 2-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
3. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
4. Washer and Nut: Zinc-coated steel.

- C. Threaded Inserts: Galvanized malleable iron or galvanized steel for 3/4 inch bolts.

1. Manufacturers:

- a. Superior Concrete Accessories; Threaded Insert.
- b. Dayton Sure-Grip and Shore Co.
- c. Richmond Screw Anchor Co.

D. Slotted Inserts: Continuous galvanized steel with temporary slot fillers and complete with nuts, studs, washers and the like, for 3/4 inch bolts.

1. Manufacturers:

- a. B-Line by Eaton; B22-I Continuous Concrete Insert.
- b. Hilti, Inc.; CIS13812/PG.
- c. Hohman and Barnard, Inc.
- d. Richmond Screw Anchor Co.
- e. Unistrut; a part of Atkore International; P-3200 Continuous Insert.

## 2.11 ROOF MOUNTED PIPING SUPPORTS

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Low, Fixed-Height, Single-Base Stand: Assembly of base and horizontal member, and pipe support, for roof installation without membrane penetration.

1. Manufacturers:

- a. B-Line by Eaton; Dura-Blok.
- b. Eco Support Products.
- c. MIFAB, Inc.; C-Port.
- d. MIRO Industries; Conduit and Condensate Supports.
- e. nVent Electric plc; CADDY.
- f. Portable Pipe Hangers.

2. Base: Plastic, stainless steel, or recycled rubber.

3. Horizontal Member: Cadmium-plated-steel or galvanized-steel strut designed for use with standard strut clamps and accessories.

C. Low, Adjustable-Height, Single-Base Stand: Assembly of base, horizontal member, and adjustable vertical members, and pipe support, for roof installation without membrane penetration.

1. Manufacturers:

- a. B-Line by Eaton; Dura-Blok.
- b. Eco Support Products.
- c. MIFAB, Inc.; C-Port.
- d. MIRO Industries; Conduit and Condensate Supports.
- e. nVent Electric plc; CADDY.
- f. Portable Pipe Hangers.

2. Base: Plastic, stainless steel, or recycled rubber.

3. Horizontal Member: Cadmium-plated-steel or galvanized-steel strut designed for use with standard strut clamps and accessories.

4. Vertical Members: Threaded, hot rolled, steel rod conforming to ASTM A 36 or A575 with cadmium plated nuts and washers. Rod continuously threaded.

- D. High, Adjustable-Height, Single-Base Stand: Assembly of base, horizontal member, and adjustable vertical members, and clevis type pipe support, for roof installation without membrane penetration.
1. Manufacturers:
    - a. B-Line by Eaton; Dura-Blok.
    - b. Eco Support Products.
    - c. MIFAB, Inc.; C-Port.
    - d. MIRO Industries; Water and Steam Supports.
    - e. nVent Electric plc; CADDY.
    - f. Portable Pipe Hangers.
  2. Base: Plastic, stainless steel, or recycled rubber.
  3. Horizontal Member: Cadmium-plated-steel or galvanized-steel strut designed for use with standard strut clamps and accessories.
  4. Vertical Members: Threaded, hot rolled, steel rod conforming to ASTM A 36 or A575 with cadmium plated nuts and washers. Rod continuously threaded.
- E. Low, Fixed-Height, Single-Base Roller Stand: Assembly of base and horizontal roller, for roof installation without membrane penetration.
1. Manufacturers:
    - a. B-Line by Eaton; Dura-Blok.
    - b. Eco Support Products.
    - c. MIFAB, Inc.; C-Port.
    - d. MIRO Industries; Gas and Mechanical Supports.
    - e. nVent Electric plc; CADDY.
    - f. Portable Pipe Hangers.
  2. Base: Plastic, stainless steel, or recycled rubber.
  3. Horizontal Member: Cadmium-plated-steel rod and corrosion resistant roller designed for use with standard accessories.
- F. Low, Adjustable-Height, Single-Base Roller Stand: Assembly of base and horizontal roller, for roof installation without membrane penetration.
1. Manufacturers:
    - a. B-Line by Eaton; Dura-Blok.
    - b. Eco Support Products.
    - c. MIFAB, Inc.; C-Port.
    - d. MIRO Industries; Gas and Mechanical Supports.
    - e. nVent Electric plc; CADDY.
    - f. Portable Pipe Hangers.
  2. Base: Plastic, stainless steel, or recycled rubber.
  3. Horizontal Member: Cadmium-plated-steel rod and corrosion resistant roller designed for use with standard accessories.
  4. Vertical Members: Threaded, hot rolled, steel rod conforming to ASTM A 36 or A575 with cadmium plated nuts and washers. Rod continuously threaded.
- G. High, Multiple-Base Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
1. Manufacturer:

- a. B-Line by Eaton; Dura-Blok.
  - b. Eco Support Products.
  - c. MIFAB, Inc.; C-Port.
  - d. MIRO Industries; Water and Steam Supports.
  - e. nVent Electric plc; CADDY.
  - f. Portable Pipe Hangers.
2. Bases: Two or more plastic, steel, or recycled rubber.
  3. Vertical Members: Two or more protective-coated-steel channels.
  4. Horizontal Member: Protective-coated-steel channel.
  5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- H. Custom, Multiple-Base Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports or rollers, for roof installation without membrane penetration.
1. Manufacturer:
    - a. B-Line by Eaton; Dura-Blok.
    - b. Eco Support Products.
    - c. MIFAB, Inc.; C-Port.
    - d. MIRO Industries; Custom Design Products.
    - e. nVent Electric plc; CADDY.
    - f. Portable Pipe Hangers.
  2. Bases: Four or more plastic, steel, or recycled rubber.
  3. Vertical Members: Two or more protective-coated-steel channels.
  4. Horizontal Member: Protective-coated-steel channel.
  5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
  6. Pipe Rollers: Cadmium-plated-steel rod and corrosion resistant roller designed for use with standard accessories.
- I. Curb-Mounting Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.
1. Roof Curb Type Supports: Coordinate installation and type with Architectural Trades. Top shall be level and extend a minimum of 10 inches above top of roof insulation.
    - a. Manufacturers:
      - 1) Pate.
      - 2) Thybar; Thycurb.
      - 3) Roof Products and Systems.
      - 4) Greenheck.
      - 5) Creative Metals.

## 2.12 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

## 2.13 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT APPLICATIONS

- A. Refer to application schedules on the Drawings.
- B. For insulated pipe, oversize hanger elements to accommodate insulation thickness.
- C. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- D. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- E. Use hangers and supports with galvanized, metallic coatings for outdoor applications or where exposed to outdoor conditions.
- F. Use hangers and supports with plastic coating, or galvanized metallic coatings for applications in corrosive atmospheres.
- G. Use metal framing, with plastic coating, or galvanized metallic coatings for metal framing in corrosive atmospheres.
- H. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- I. Use padded hangers for piping that is subject to scratching.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. MSS Type 8 or spring type to meet system requirements.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- L. Concrete Structure Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Anchor Devices, Concrete and Masonry: in accordance with Group I, Group II, Type 2, Class 2, Style 1 and Style 2, Group III and Group VIII or FS FF-S-325A. Furnish cast-in floor type equipment anchor devices with adjustable positions. Furnish built in anchor devices for masonry, unless otherwise approved by the Architect. Powder actuated anchoring devices shall not be used to support any mechanical systems components.
  2. Inserts, Concrete: TYPE 18 or 19. When applied to loads equivalent to piping in sizes NPS 2 and larger, and where otherwise required by imposed loads, a one foot length of 1/2 inch reinforcing rod shall be inserted and wired through wing slots. Proprietary type continuous inserts may be proposed and shall be submitted for approval.
  3. Use mechanical-expansion anchors where required in concrete construction.
  4. Use chemical fasteners where required in concrete construction.
- M. Steel Frame Structure Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Beam Clamps:
    - a. Center Loading: TYPE 21, 28, 29 and 30, unless otherwise indicated. Type 27 shall be allowed to support single pipes NPS 6 size or smaller only.
    - b. "C" Clamps: Type 19, 20 or 23, for supporting single pipes NPS 2-1/2 size or smaller only. Use of "C" clamps, or beam clamps of "C" pattern, or any modification thereof, is prohibited for supporting multiple pipes or pipes larger than NPS 2-1/2.
- N. Hanger-Rod Attachments for Wood Construction: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. All Steel Ceiling Plates: UL listed and suitable for attachment to wood beams. For pipe sizes NPS 1/2 to NPS 2. Install in accordance with manufacturer's instructions to maintain listing.
  2. Threaded Side Beam Brackets: UL listed and FMG approved, suitable for attachment to wood beams. For pipe sizes NPS 2 to NPS 4. Install in accordance with manufacturer's instructions to maintain listing.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Use spring supports and sway braces TYPES 48, 49, 50, 51, 52, 53, 54, 55 or 56. For specific points:
    - a. Provide spring supports at point of support where vertical movement will occur.
    - b. For light loads and vertical movement less than 1/4 inch, TYPES 48 or 49 spring cushion supports.
    - c. For vertical movements in excess of 1/4 inch but less than 1/2 inch, TYPES 51, 52 or 53 variable spring supports shall be used, loaded to not more than 75 percent of published load rating.
    - d. For vertical movements of 1/2 inch and more, TYPES 54, 55 and 56 constant support spring hangers.

- e. Sway braces; TYPE 50.
  - f. Variable spring hangers in accordance with referenced MSS Standards with "medium" allowable load change.
- P. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

### 3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structural frame.
- B. Provide necessary piping and equipment supporting elements including: building structure attachments, supplementary steel, hanger rods, stanchions and fixtures, vertical pipe attachments, horizontal pipe attachments, anchors, guides, spring supports in accordance with the referenced codes, standards, and requirements specified. Support piping and equipment from building structure, not from roof deck, floor slab, other pipe, duct or equipment.
- C. At connections between piping systems, hangers and equipment of dissimilar metals, insulate, using dielectric insulating material, nonferrous piping against direct contact with the building steel by insulating the contact point of the hanger and pipe or the hanger and building steel. Test each point of dielectric insulation with an ohm meter to ensure proper isolation of dissimilar materials. Test shall be observed by the Owner's Representative and/or Architect.
- D. Use copper plated or plastic coated supporting element in contact with copper tubing or glass piping.
- E. File and paint cut ends and shop or field prime paint supporting element components.
- F. Hang piping parallel with the lines of the building, unless otherwise indicated. Route piping in an orderly manner and maintain gradient. Space piping and components so a threaded pipe fitting may be removed between adjacent pipes and so there will be not less than 1/2 inch of clear space between finished surfaces and piping. Arrange hangers on adjacent parallel service lines in line with each other.
- G. Flange loads on connected equipment shall not exceed 75 percent of maximum allowed by equipment manufacturer. Flange loads in liquid containing systems shall be checked in the presence of the Architect when piping is full of liquid. No flange load is allowed on pumps, vibration isolated equipment or flexible connectors.
- H. Spring supports, within specified limitations: Constant support type, where necessary to avoid transfer of load from support to support or onto connected equipment; otherwise, variable support type located at points subject to vertical movement.
- I. Incorporate pipe anchors into piping systems to maintain permanent pipe positions. Install alignment guides for the piping adjacent to and on each side of pipe expansion loops and expansion joints to maintain alignment.
- J. Where necessary, brace piping and supports against reaction, sway and vibration.

- K. Do not hang piping from concrete joist pans, floor decks, roof decks, equipment, ductwork, or other piping.
- L. Install turnbuckles, swing eyes and clevises to accommodate temperature changes, pipe accessibility, and adjustment for load pitch. Rod couplings are not acceptable.
- M. Install hangers and supports for piping at intervals specified, at locations not more than 3 feet from the ends of each runout, not more than 3 feet from connections to equipment, and not over 25 percent of specified interval from each change in direction of piping and for concentrated loads such as valves, etc.
- N. Base the load rating for pipe support elements on loads imposed by insulated weight of pipe filled with water. The span deflection shall not exceed slope gradient of pipe.
- O. If structural steel, roofs, or tunnels will allow support spacing greater than that shown above, Contractor shall submit proposed support system along with structural calculations documenting the allowance of such spacing, in accordance with ANSI, B31.1, and MSS Guidelines.
- P. Support vertical risers independently of connected horizontal piping whenever practical, with supports at the base and at intervals to accommodate system range of load with thermal conditions. Support vertical risers at each floor penetration for piping in shafts or chases. Guide for lateral stability. Fit horizontal piping connected to moving risers with two spring supports connected adjacent to riser, spaced according to required hanger spacing.
- Q. For risers at temperatures of 100 deg F or less place riser clamps under fittings. Support carbon steel pipe at each operating level or floor and at not more than 15-foot intervals for pipe 2 inches and smaller, and at not more than 20 foot intervals for pipe 2-1/2 inches and larger.
- R. After the piping systems have been installed, tested and placed in satisfactory operation, firmly tighten hanger rod nut and jam nut and upset threads to prevent movement of fasteners.
- S. Attach pipe anchors and pipe alignment guides to the building structure where indicated. If not indicated, the method used is optional to the Contractor, subject to approval by the Architect. In the case of structural steel, make attachment by clamping in accordance with the American Institute of Steel Construction Specification for the Design, Fabrication and Erection of Structural Steel for Building.
- T. Attach supporting elements connected to structural steel columns to preclude vertical slippage and cascading failure.
- U. Attach pipe hangers and other supporting elements to roof purlins and trusses at panel points.
- V. Where eccentric loading beam clamps are approved and where other work is supported by similar eccentric loading support element from the same structural member, locate eccentric loading support elements to minimize structural member torsion load.
- W. Limit the location of supporting elements for piping and equipment, when supported from roof, to panel points of the bar joists.
- X. Building structure shall not be reinforced except as approved by the Architect in writing.



- Y. Use approved cast-in-place inserts or built-in anchors for attachment to concrete structure. Size inserts and anchors for the total applied load with a safety factor in accordance with applicable codes but in no case less than 5. Coordinate installation of all imbedded items in accordance with manufacturer's instructions. Position anchorage and imbedded items as indicated and/or where required and support against displacement during placing of concrete. Cutting or repositioning of concrete beam or girder or reinforcing steel to accommodate inserts will not be allowed. Provide removable closures in imbedded device openings to prevent entry of concrete.
- Z. Support piping and equipment from concrete building frame, not from roof or floor slabs unless otherwise indicated.
- AA. Use cast-in-place inserts in concrete beams and girders. Drilled anchors/wedge type inserts shall be used on vertical surfaces only. Coordinate with structural engineer.
- BB. Attach piping supports to the side of concrete beams and concrete joist. Provide supplementary support steel as required. Cast-in-place or drilled anchors will not be permitted in the bottom of concrete beams and concrete joist.
- CC. Attach piping supports to the side of concrete beams or concrete joist. Where intermediate hangers are required to meet the hanger spacing schedule, the Contractor may propose attachment of intermediate pipe supports to the bottom of the concrete slab pending submittal of a satisfactory pull out test. The Contractor shall submit pull out test criteria, pull out test results, proposed hanger detail and hanger point loads to the Architect for written approval.
- DD. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- EE. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- FF. Fastener System Installation:
  - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- GG. Roof-Mounting Pipe and Equipment Stand Installation:
  - 1. Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  - 2. Curb or Rail Mounting Type Stands: Assemble components or fabricate stand and mount on permanent, stationary roof curb or rail. Refer to Division 07 Section "Roof Accessories" for curb and rail installation.
  - 3. Maintain support manufacturer's recommended spacing.
- HH. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

- II. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- JJ. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- KK. Install lateral bracing with pipe hangers and supports to prevent swaying.
- LL. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- MM. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- NN. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- OO. Refer to individual piping sections for hanger spacing and hanger rod sizes.

### 3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Equipment Supports: Painting is specified in Division 09 painting Sections.
- C. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- D. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 200529

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."

1.2 SUBMITTALS

- A. Product Data: Include load deflection curves for each vibration isolation device.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include the following:
  - 1. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
  - 2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification that riser system has been examined for excessive stress and that none will exist.
  - 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.

### 1.3 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. Installation of these items is specified in Division 07 Section "Roof Accessories."

## PART 2 - PRODUCTS

### 2.1 VIBRATION ISOLATION EQUIPMENT BASES

#### A. **Type A:** Direct Isolator Attachment

- 1. Unit to be isolated is so constructed that vibration isolators of the type specified may be directly attached, provided that the edge deflection of the isolated unit base over unsupported span between mountings does not exceed specified or manufacturer's limits. If units to be isolated will not meet required deflection provisions, Type B bases shall be provided.

#### B. **Type B:** Factory-fabricated, welded, structural-steel bases or rails.

##### 1. Structural Steel Bases:

- a. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Type WF or a comparable product by one of the following:
  - 1) Amber/Booth; a VMC Group Company.
  - 2) Kinetics Noise Control, Inc.
  - 3) Korfund Dynamics; a VMC Group Company.
  - 4) Vibration Eliminator Co., Inc.
  - 5) Vibration Isolation Co., Inc. (Pump Bases Only)
  - 6) Vibration Mountings & Controls; a VMC Group Company.
  - 7) Vibro-Acoustics.
- b. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails. Include supports for suction and discharge elbows for pumps.
- c. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
- d. Support Brackets: Factory-welded steel angles on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

##### 2. Structural-Steel Rails:

- a. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Type ICS or a comparable product by one of the following:
  - 1) Amber/Booth; a VMC Group Company.

- 2) Kinetics Noise Control, Inc.
  - 3) Korfund Dynamics; a VMC Group Company.
  - 4) Vibration Eliminator Co., Inc.
  - 5) Vibration Isolation Co., Inc. (Pump Bases Only)
  - 6) Vibration Mountings & Controls; a VMC Group Company.
  - 7) Vibro-Acoustics.
- b. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails. Include supports for suction and discharge elbows for pumps.
  - c. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
  - d. Support Brackets: Factory-welded steel angles on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
- C. **Type C** Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for field-applied, cast-in-place concrete.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Type BMK/KSL or a comparable product by one of the following:
    - a. Amber/Booth; a VMC Group Company.
    - b. Kinetics Noise Control, Inc.
    - c. Korfund Dynamics; a VMC Group Company.
    - d. Vibration Eliminator Co., Inc.
    - e. Vibration Isolation Co., Inc. (Pump Bases Only)
    - f. Vibration Mountings & Controls; a VMC Group Company.
    - g. Vibro-Acoustics.
  2. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails. Include supports for suction and discharge elbows for pumps.
  3. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
  4. Support Brackets: Factory-welded steel angles on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
  5. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.
- D. **Type D** Curb Mounted Aluminum Bases:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Type CMAB or a comparable product by one of the following:
    - a. Kinetics Noise Control, Inc.
    - b. ThyCurb/Thybar.
    - c. Vibro-Acoustics.
    - d. Vib-Iso.

2. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment.
3. Upper Frame: Corrosion resistant extruded aluminum. Upper frame shall overlap lower frame for water runoff. Mitered ends heliarc welded to prevent water leakage through corners.
4. Lower Frame: Corrosion resistant extruded aluminum. Lower framed shall overlap roof curb for water runoff. Mitered ends heliarc welded to prevent water leakage through corners.
5. Safety Stops: Neoprene, mounted in corners of lower frame for extreme wind conditions and mild seismic disturbances under normal conditions.
6. Isolators: Cadmium plated free-standing springs with positive spring retainer and flexible ties.
7. Splicing Kit: Required for bases shipped in multiple pieces.
8. Weatherseal: Flexible frictionless EPDM.
9. Static Deflection: Nominal 1 inch.

E. **Type E Rooftop Spring Curb:**

1. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Type RSC or a comparable product by one of the following:
  - a. Kinetics Noise Control, Inc.
  - b. ThyCurb/Thybar.
  - c. Vibro-Acoustics.
2. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment; and to withstand wind forces as required by local codes.
3. Lower Support Assembly: Sheet-metal "Z" section containing adjustable and removable steel springs that support upper floating frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist wind forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly.
4. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch- thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.
  - a. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with restraint.
    - 1) Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
    - 2) Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
    - 3) Minimum Additional Travel: 50 percent of the required deflection at rated load.
    - 4) Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
    - 5) Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

- b. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers (maximum 3 layers separated by steel shims) to achieve 90 percent efficiency, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
  - 1) Material: Bridge-bearing neoprene, complying with AASHTO M 251.
  - 2) Durometer Rating: 40.
5. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.
6. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.
7. Sound Isolation: Within perimeter of roof curb rails and as detailed on the Drawings:
  - a. Two layers of 2-inch thick board insulation, minimum 3-lb/cu. ft. density, glass fibers bonded with a thermosetting resin. Comply with ASTM C 612 Type IA or Type IB.
  - b. Two layers of 5/8-inch thick water-resistant gypsum core wall panel surfaced with paper on front, back, and long edges. Comply with ASTM C 1396.
  - c. One layer of 6-inch thick fiberglass blanket insulation.
8. Static Deflection: Nominal 1 inch, 2 inches, or 3 inches.

## 2.2 VIBRATION ISOLATORS

- A. **Type 1a** Elastomeric Isolator Pads: Oil- and water-resistant elastomer, arranged in single or multiple layers (maximum 3 layers separated by steel shims) to achieve 90 percent efficiency, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
  1. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Type W, Super W, WSW, and WSWSW or comparable products by one of the following:
    - a. Amber/Booth; a VMC Group Company.
    - b. Kinetics Noise Control, Inc.
    - c. Korfund Dynamics; a VMC Group Company.
    - d. Vibration Eliminator Co., Inc.
    - e. Vibration Mountings & Controls; a VMC Group Company.
    - f. Vibro-Acoustics.
  2. Material: Standard neoprene for indoor applications.
  3. Material: Bridge-bearing neoprene, complying with AASHTO M 251 for outdoor applications.
- B. **Type 1b** Elastomeric Isolator Pads: Oil- and water-resistant elastomer, single layer, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and 1/4 inch steel load bearing plate. Factory cut to sizes that match requirements of supported equipment.



1. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Type Super WMSW and MBSW or a comparable product by one of the following:
    - a. Amber/Booth; a VMC Group Company.
    - b. Kinetics Noise Control, Inc.
    - c. Korfund Dynamics; a VMC Group Company.
    - d. Vibration Eliminator Co., Inc.
    - e. Vibration Mountings & Controls; a VMC Group Company.
    - f. Vibro-Acoustics.
  2. Material: Standard neoprene for indoor applications.
  3. Material: Bridge-bearing neoprene, complying with AASHTO M 251 for outdoor applications.
- C. **Type 2** Elastomeric Mounts: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Type ND or a comparable product by one of the following:
    - a. Amber/Booth; a VMC Group Company.
    - b. Kinetics Noise Control, Inc.
    - c. Korfund Dynamics; a VMC Group Company.
    - d. Vibration Eliminator Co., Inc.
    - e. Vibration Mountings & Controls; a VMC Group Company.
    - f. Vibro-Acoustics.
  2. Durometer Rating: Selected for maximum possible static deflection with the loading of each piece of equipment.
  3. Materials: Cast-ductile-iron housing containing two separate and opposing, molded, bridge-bearing neoprene elements that prevent central threaded sleeve and attachment bolt from contacting the casting during normal operation.
  4. Neoprene: Bridge-bearing neoprene as defined by AASHTO.
- D. **Type 3** Spring Isolators: Freestanding, open-spring isolators.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Type SLF or a comparable product by one of the following:
    - a. Amber/Booth; a VMC Group Company.
    - b. Kinetics Noise Control, Inc.
    - c. Korfund Dynamics; a VMC Group Company.
    - d. Vibration Eliminator Co., Inc.
    - e. Vibration Mountings & Controls; a VMC Group Company.
    - f. Vibro-Acoustics.
  2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch-thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 100 psig.
  6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- E. **Type 4** Restrained Spring Isolators: Restrained single and multiple spring mounts.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Types SLR and SLRS or comparable products by one of the following:
    - a. Amber/Booth; a VMC Group Company.
    - b. Kinetics Noise Control, Inc.
    - c. Korfund Dynamics; a VMC Group Company.
    - d. Vibration Eliminator Co., Inc.
    - e. Vibration Mountings & Controls; a VMC Group Company.
    - f. Vibro-Acoustics.
  2. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch-thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
  3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- F. **Type 5** Thrust Restraints:
1. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression or tension as required, and with a load stop. Include rod and angle-iron brackets with back-up plates for attaching to equipment and ductwork.
    - a. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Type WBI for fan inlet connections, and Type WBD for fan outlet connections, or comparable products by one of the following:
      - 1) Amber/Booth; a VMC Group Company.
      - 2) Kinetics Noise Control, Inc.
      - 3) Korfund Dynamics; a VMC Group Company.
      - 4) Vibration Eliminator Co., Inc.
      - 5) Vibration Mountings & Controls; a VMC Group Company.
      - 6) Vibro-Acoustics.
    - b. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
    - c. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
    - d. Minimum Additional Travel: 50 percent of the required deflection at rated load.
    - e. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.

- f. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- g. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
- h. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

## 2.3 VIBRATION ISOLATION HANGERS

### A. **Type 8a** Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Type 30N or a comparable product by one of the following:
  - a. Amber/Booth; a VMC Group Company.
  - b. Kinetics Noise Control, Inc.
  - c. Korfund Dynamics; a VMC Group Company.
  - d. Vibration Eliminator Co., Inc.
  - e. Vibration Mountings & Controls; a VMC Group Company.
  - f. Vibro-Acoustics.
- 2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
- 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
- 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
- 5. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
- 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- 7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

### B. **Type 8b** Spring Hangers with Vertical-Limit Stop: Precompressed combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Type PC30N or a comparable product by one of the following:
  - a. Amber/Booth; a VMC Group Company.
  - b. Kinetics Noise Control, Inc.
  - c. Korfund Dynamics; a VMC Group Company.
  - d. Vibration Eliminator Co., Inc.
  - e. Vibration Mountings & Controls; a VMC Group Company.
  - f. Vibro-Acoustics.
- 2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
- 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
- 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.

5. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

## 2.4 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
  1. Powder coating on springs and housings.
  2. All hardware shall be electrogalvanized. Hot-dip galvanize metal components for exterior use.
  3. Baked enamel for metal components on isolators for interior use.
  4. Color-code or otherwise mark vibration isolation devices to indicate capacity range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation devices for compliance with requirements, installation tolerances, and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install roof curbs, equipment supports, and roof penetrations as specified in Division 07 Section "Roof Accessories."
- B. Install thrust limits at centerline of thrust, symmetrical on either side of equipment.

### 3.3 APPLICATION

- A. Refer to Vibration Isolator Application Schedule on the drawings for isolator application and minimum deflection.

### 3.4 CONNECTIONS

- A. Provide flexible electrical connections in the form of large radius, 360 degree loop of flexible conduit for all vibrating isolated equipment. Any cooling water lines, compressed air, or other piping services (except inlet and outlet water connections for pumps, chillers or cooling tower) shall be made with 360 degree loops of

reinforced neoprene hose, which are attached using nipples of appropriate gender. All service connections made with neoprene hose shall have shut-off valves between the hose and the supply service.

- B. Vibration isolate piping connected to vibration isolated equipment using Type 8a or 8b spring hangers, and with distance to be isolated as scheduled on the Drawings. Maximum spacing between isolators same as maximum distance between pipe hangers and supports.
- C. Vibration isolate ductwork connected to air handling units, return air fans, and vibration isolated equipment using Type 8a or 8b spring hangers, and in accordance with isolation distances scheduled on the Drawings.

### 3.5 EQUIPMENT BASES

- A. Fill concrete inertia bases, after installing base frame, with 3000-psi concrete; trowel to a smooth finish.
  - 1. Cast-in-place concrete materials and placement requirements are specified in Division 03.
- B. Concrete Bases: Anchor equipment to concrete base according to supported equipment manufacturer's written instructions.
  - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
  - 2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base and anchor into structural concrete floor.
  - 3. Place and secure anchorage devices. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  - 6. Cast-in-place concrete materials and placement requirements are specified in Division 03.

### 3.6 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
  - 1. Isolator deflection.
  - 2. Snubber minimum clearances.

### 3.7 ADJUSTING

- A. Adjust isolators after piping systems have been filled and equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

- C. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.
- D. Adjust active height of spring isolators.
- E. Adjust snubbers according to manufacturer's written recommendations.

### 3.8 CLEANING

- A. After completing equipment installation, inspect vibration isolation devices. Remove paint splatters and other spots, dirt, and debris.

END OF SECTION 200547

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in Maintenance Manuals.

### 1.3 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME (ANSI) A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

### 1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified:
  - 1. Brady.
  - 2. EMED.
  - 3. Craftmark.
  - 4. Brimar Industries, Inc.
  - 5. Marking Services Inc. (MSI).
  - 6. Kolbi Pipe Marker Co.

### 2.2 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
  - 1. Manufacturer, product name, model number, and serial number.
  - 2. Capacity, operating and power characteristics, and essential data.
  - 3. Labels of tested compliances.
    - a. Fasteners: As required to mount on equipment.
- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
  - 1. Data:
    - a. Name and plan number.
    - b. Equipment service.
    - c. Design capacity.
    - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.



- C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
  - 1. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
  - 2. Thickness: Minimum 1/16 inch, unless otherwise indicated.
  - 3. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.
- D. Access Panel and Door Markers: 1/16-inch- thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.

### 2.3 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
  - 1. Type and Size of Letters: Comply with ANSI A13.1, unless otherwise indicated.
  - 2. Legends: Spelled out in full or commonly used and accepted abbreviations.
  - 3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
  - 4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
  - 5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.
- C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.
- D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.
- E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.
  - 1. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.
- F. Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inches wide by 4mil thick, manufactured for direct burial service.
- G. Detectable Underground Pipe Markers: Continuously printed plastic ribbon tape with detectable aluminum core and with colors meeting APWA requirements, not less than 6 inches wide by 4 mil thick, manufactured for direct burial service.

## 2.4 DUCT IDENTIFICATION DEVICES

- A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow, air handling unit or fan number, and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.
- B. Duct Markers: Vinyl, 2-inch minimum character height, with permanent pressure sensitive adhesive. Include direction and quantity of airflow, air handling unit or fan number, and duct service (such as supply, return, and exhaust).

## 2.5 HAZARDOUS MATERIAL IDENTIFICATION DEVICES

- A. Standard: NFPA 704.
- B. Material: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive; or mounting screws.
- C. Size: Minimum 7-1/2 inches by 7-1/2 inches with 3-inch character height.
- D. Content: Appropriate for refrigerant.

## 2.6 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme (To match existing numbering scheme). Provide 5/32-inch hole for fastener.
  - 1. Valve-Tag Fasteners: Brass wire-link chain or beaded chain.

## 2.7 VALVE SCHEDULES

- A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  - 1. Page of valve schedule. Include mounting screws.
  - 2. Frame: Finished hardwood or extruded aluminum.
  - 3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

## 2.8 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
  - 1. Fasteners: Brass grommet and wire.
  - 2. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
  - 3. Color: Yellow background with black lettering.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 20, 21, 22, and 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

### 3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
1. Pumps, compressors, chillers, condensers, and similar motor-driven units.
  2. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
  3. Fans, blowers, primary balancing dampers, and mixing boxes.
  4. Packaged HVAC central-station and zone-type units.
- B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
1. For viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
  3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
    - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    - b. Fire department hose valves and hose stations.
    - c. Meters, gages, thermometers, and similar units.
    - d. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
    - e. Pumps, compressors, chillers, condensers, and similar motor-driven units.
    - f. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
    - g. Fans, blowers, primary balancing dampers, and mixing boxes.
    - h. Packaged HVAC central-station and zone-type units.
    - i. Tanks and pressure vessels.
    - j. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
- C. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.
1. Green: For cooling equipment and components.
  2. Yellow: For heating equipment and components.
  3. Orange: For combination cooling and heating equipment and components.

4. Brown: For energy-reclamation equipment and components.
  5. For viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  6. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
  7. Include signs for the following general categories of equipment:
    - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    - b. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
    - c. Pumps, compressors, chillers, condensers, and similar motor-driven units.
    - d. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
    - e. Fans, blowers, primary balancing dampers, and mixing boxes.
    - f. Packaged HVAC central-station and zone-type units.
    - g. Tanks and pressure vessels.
    - h. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
- D. Install access panel markers with screws on equipment access panels.
- E. Area Served: Equipment serving different areas of a building other than where the equipment is installed shall be permanently marked in a manner that, in addition to identifying the equipment as specified in this Section, also identifies the area it serves.

### 3.3 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow, ensure a tight fit.
1. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, minimum 3/4 inch wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
  2. Pipes with OD, Including Insulation, 6 Inches and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.
  3. Pipes with OD, Including Insulation, 6 Inches and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, minimum 1-1/2 inches wide, lapped at least 3 inches at both ends of pipe marker, and covering full circumference of pipe.
- B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:
1. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  2. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
  3. At access doors, manholes, and similar access points that permit view of concealed piping.
  4. Near major equipment items and other points of origination and termination.

5. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
6. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

- C. Underground Pipe Markers: Install 6 to 8 inches below finished grade, directly above buried pipe.

### 3.4 DUCT IDENTIFICATION

- A. Install engraved duct markers with permanent adhesive on air ducts in the following color codes:
  1. ASME (ANSI) A13.1 Colors and Designs: For hazardous material exhaust.
  2. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- B. Identify ductwork with vinyl markers and flow direction arrows.
- C. Locate markers at air handling units, each side of floor and wall penetrations, near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

### 3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:
  1. Cold Water: Minimum 1-1/2 inches, round or square.
  2. Hot Water: Minimum 1-1/2 inches, round or square.

### 3.6 VALVE-SCHEDULE INSTALLATION

- A. Mount valve schedule on wall in accessible location in each major equipment room.

### 3.7 HAZARDOUS MATERIAL IDENTIFICATION DEVICES

- A. Mount to wall or door of room containing hazard. Indicate classification of refrigerant or other hazard.

3.8 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

3.9 ADJUSTING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.10 CLEANING

- A. Clean faces of mechanical identification devices and glass frames of valve schedules.

3.11 SCHEDULES

- A. Paint colors are listed here for reference only. Painting is specified under Division 9.

PIPE LABELING AND COLOR CODING

<u>Pipe System Label</u>	<u>Drawing Abbrev.</u>	<u>Labels</u>	<u>Piping</u>
Sanitary Sewer	SAN	White on Green	Dark Brown
Sanitary Vent	V	White on Green	Dark Brown
Rain Conductor	RC	White on Green	Dark Brown
Domestic Cold Water	CW	White on Green	Light Green
Non-Potable Cold Water	NPCW	Black on Yellow	
Domestic Hot Water	HW	Black on Yellow	Dark Green
Domestic Hot Water Return	HWR	Black on Yellow	Dark Green
Natural Gas	G	Black on Yellow	Yellow
Hot Water Htg. Supply	HWHS	Black on Yellow	Dark Blue
Hot Water Htg. Return	HWHR	Black on Yellow	Dark Blue
Terminal Unit Heating Sup.	THS	Black on Yellow	Dark Blue
Terminal Unit Heating Ret.	THR	Black on Yellow	Dark Blue
Chilled Water Supply	CHWS	White on Green	Light Blue
Chilled Water Return	CHWR	White on Green	Light Blue
Refrigerant Liquid	RL	Black on Yellow	
Refrigerant Suction	RS	Black on Yellow	
Fire Protection	FP	White on Red	Bright Red

SHEET METAL WORK

<u>Service</u>	<u>Abbrev.</u>	<u>Labels</u>	<u>Ductwork</u>
Air Conditioning Supply	Supply Air	White on Green	White
Air Conditioning Return	Return Air	White on Green	White
Exhaust Systems	Exhaust Air	Black on Yellow	Green
Outside Air Intake	Outside Air	White on Green	White
Mixed Air	Mixed Air	White on Green	White

END OF SECTION 200553

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Materials and Methods."
  - 3. Division 20 Section "Hanger and Supports" for thermal hanger shield inserts.

## 1.2 SUMMARY

- A. This Section includes mechanical insulation for pipe, duct, and equipment.

## 1.3 DEFINITIONS

- A. ASJ: All-service jacket.
- B. FSK: Foil, scrim, kraft paper.
- C. FSP: Foil, scrim, polyethylene.
- D. PVC: Polyvinyl Chloride.
- E. PVDC: Polyvinylidene chloride.
- F. SSL: Self-sealing lap.

## 1.4 INDOOR PIPING INSULATION SYSTEMS DESCRIPTION

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are scheduled on the Drawings, or identified for each piping system and pipe size range.

## 1.5 INDOOR DUCT AND PLENUM INSULATION SYSTEMS DESCRIPTION

- A. Acceptable indoor duct and plenum insulation materials and thicknesses are scheduled on the Drawings.

## 1.6 FIELD-APPLIED JACKETING SYSTEMS DESCRIPTION

- A. Acceptable field-applied jacketing materials and thicknesses are scheduled on the Drawings, or identified for each piping system and pipe specialty.

## 1.7 SUBMITTALS

- A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).
  - 1. ESR Report: For fire-rated grease duct insulation.
- B. Shop Drawings: Show details for the following:
  - 1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Attachment and covering of heat tracing inside insulation.
  - 3. Insulation application at pipe expansion joints for each type of insulation.
  - 4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 5. Removable insulation at piping specialties, equipment connections, and access panels.



6. Application of field-applied jackets.
  7. Application at linkages of control devices.
  8. Field application for each equipment type
  9. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.
- C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- D. Field quality-control inspection reports.

#### 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
- C. Ductwork Maximum Temperature Limits: Based on ASTM C 411 test procedures.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Prior to installation, protect insulation from exposure to water and from physical damage. Prior to installation, store insulation in manufacturer's original packaging.

#### 1.10 COORDINATION

- A. Coordinate size and location of supports, hangers, and pre-insulated pipe shields/supports specified in Division 20 Section "Hangers and Supports."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.11 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS, GENERAL REQUIREMENTS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. Adhesives used shall be fire resistant in their dry states and UL listed.
- F. Glass-Fiber, Preformed Pipe Insulation, Type I:
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Johns Manville; Micro-Lok.
    - b. Knauf Insulation; 1000 Pipe Insulation.
    - c. Manson Insulation Inc.; Alley-K.
    - d. Owens Corning; Fiberglas Pipe Insulation.
  - 2. Type I, 850 deg F Materials: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ or ASJ-SSL. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

2.2 DUCTWORK INSULATION MATERIALS

- A. Blanket Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket I. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. CertainTeed Corp.; Duct Wrap.
    - b. Johns Manville; Microlite EQ.

- c. Knauf Insulation; Duct Wrap.
  - d. Manson Insulation Inc.; Alley Wrap FSK.
  - e. Owens Corning; All-Service Duct Wrap.
- B. Board Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
- 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. CertainTeed Corp.; Commercial Board.
    - b. Fibrex Insulations Inc.; FBX.
    - c. Johns Manville; 800 Series Spin-Glas.
    - d. Knauf Insulation; Insulation Board.
    - e. Manson Insulation Inc.; AK Board.
    - f. Owens Corning; Fiberglas 700 Series.

### 2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to it and to surfaces to be insulated, unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.
    - f. Vimasco Corporation.
- C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
- 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.
- D. PVC Jacket Adhesive: Compatible with PVC jacket.
- 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Dow Chemical Company (The); 739, Dow Silicone.

- b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
- c. P.I.C. Plastics, Inc.; Welding Adhesive.
- d. Red Devil, Inc.; Celulon Ultra Clear.
- e. Speedline Corporation; Speedline Vinyl Adhesive.

## 2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
  1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; CP-35.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
    - c. ITW TACC, Division of Illinois Tool Works; CB-50.
    - d. Marathon Industries, Inc.; 590.
    - e. Mon-Eco Industries, Inc.; 55-40.
    - f. Vimasco Corporation; 749.
  2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
  5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
  1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; CP-10.
    - b. Foster Products Corporation, H. B. Fuller Company; 35-00.
    - c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
    - d. Marathon Industries, Inc.; 550.
    - e. Mon-Eco Industries, Inc.; 55-50.
    - f. Vimasco Corporation; WC-1/WC-5.
  2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 200 deg F.
  4. Solids Content: 63 percent by volume and 73 percent by weight.
  5. Color: White.

## 2.5 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
  1. Products: Subject to compliance with requirements, provide one of the products specified.

- a. Childers Products, H.B. Fuller Company; CP-76-8.
  - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
  - c. Marathon Industries, Inc.; 405.
  - d. Mon-Eco Industries, Inc.; 44-05.
  - e. Vimasco Corporation; 750.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Fire- and water-resistant, flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 40 to plus 250 deg F.
  5. Color: Aluminum.
- B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; CP-76.
  2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Fire- and water-resistant, flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 40 to plus 250 deg F.
  5. Color: White.
- C. Joint Sealants for Cellular-Glass, Phenolic-Foam, and Polyisocyanurate:
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; CP-76.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-45.
    - c. Marathon Industries, Inc.; 405.
    - d. Mon-Eco Industries, Inc.; 44-05.
    - e. Pittsburgh Corning Corporation; Pittseal 444.
    - f. Vimasco Corporation; 750.
  2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Permanently flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 100 to plus 300 deg F.
  5. Color: White or gray.

## 2.6 FACTORY-APPLIED JACKETS

- A. Insulation systems indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
  4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
  5. Vinyl Jacket: UL-rated white vinyl with a permeance of 1.3 perms when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

## 2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Vimasco Corporation; Elastafab 894.
    - b. Or approved equal.
- B. Woven Glass-Fiber Fabric for Duct and Equipment Insulation: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. inch for covering equipment.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; Chil-Glas No. 5.
    - b. Or approved equal.
- C. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for duct, equipment, and pipe.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
    - b. Vimasco Corporation; Elastafab 894.

## 2.8 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.
    - b. Lewco Products.
    - c. Mid-Mountain.
    - d. TCI.

## 2.9 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as specified; roll stock ready for shop or field cutting and forming.

1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Airex Manufacturing, Inc.; E-Flex Guard.
    - b. Johns Manville; Zeston and Ceel-Co.
    - c. P.I.C. Plastics, Inc.; FG Series.
    - d. Proto PVC Corporation; LoSmoke.
    - e. Speedline Corporation; SmokeSafe.
  2. Adhesive: As recommended by jacket material manufacturer.
  3. Color: White.
  4. Factory-fabricated tank heads and tank side panels.
- D. PVC Fitting Covers: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C, and including flexible glass fiber insulation inserts.
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Airex Manufacturing, Inc.
    - b. Johns Manville; Zeston and Ceel-Co.
    - c. P.I.C. Plastics, Inc.; FG Series.
    - d. Proto PVC Corporation; LoSmoke.
    - e. Speedline Corporation; SmokeSafe.
  2. Adhesive: As recommended by manufacturer.
  3. Color: White.
  4. Factory-fabricated fitting covers:
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, and mechanical joints.
- E. Metal Jacket:
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. PABCO-Childers Metals; ITW Insulation Systems; Metal Jacketing Systems.
    - b. RPR Products, Inc.; Insul-Mate.
  2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
    - a. Sheet and roll stock ready for shop or field sizing or factory cut and rolled to size.
    - b. Finish and thickness are indicated in field-applied jacket schedules.
    - c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
    - d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper or 2.5-mil- thick Polysurlyn.
    - e. Factory-Fabricated Fitting Covers:
      - 1) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.

- 2) Provide factory fabricated PVC tee covers, flange and union covers, beveled collars and valve covers.
  - 3) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
3. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.
- a. Sheet and roll stock ready for shop or field sizing factory cut and rolled to size.
  - b. Material, finish, and thickness are indicated in field-applied jacket systems.
  - c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
  - d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper or 2.5-mil- thick Polysurlyn.
  - e. Factory-Fabricated Fitting Covers:
    - 1) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    - 2) Provide factory fabricated PVC tee covers, flange and union covers, beveled collars and valve covers.
    - 3) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- F. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. ITW Insulation Systems; Saran 540 Vapor Retarder Film.
- G. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. ITW Insulation Systems; Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
- H. Sound Barrier Jacket: Uni-composite film laminated to 0.020 inch thick stucco embossed aluminum using viscoelastic film adhesive.
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. PABCO-Childers Metals; ITW Insulation Systems; 1 pound Muffl-Jac.
  2. Properties:
    - a. Sound Transmission Class (STC): 29.
    - b. Thickness (film): 0.080 to 0.110 inch.
    - c. Weight (film): 1 pound per square foot.
    - d. Service Temperature Range: Minus 40 deg F to 180 deg F.



3. Proprietary sound jacketing by steam pressure reducing valve manufacturer is also acceptable.

## 2.10 REMOVABLE AND REUSABLE INSULATION COVERS

- A. Flexible Style: Custom fabricated composite jackets for valves, flanges, and expansion joints consisting of 4 inches of high temperature fiberglass insulation compressed between Teflon impregnated fiberglass inner and outer facing stitched with fiberglass core Teflon thread, and secured with Velcro fasteners and double D-ring cinching. Service temperature range of minus 40 deg F to 500 deg F.

1. Fabricators:

- a. Apex Energy & Environmental Products Inc.
- b. 3i Supply Co.; K-Tex.
- c. Valley Group of Companies.

- B. Rigid Style: Custom fabricated composite jackets for valves, flanges, and expansion joints consisting of rigid foam insulation with silicone impregnated fiberglass outer facing stitched with fiberglass thread, and secured with Velcro fasteners and double D-ring cinching. Service temperature range of minus 40 deg F to 500 deg F.

1. Fabricators:

- a. Valley Group of Companies.

## 2.11 REMOVABLE AND REUSABLE ACOUSTIC INSULATION COVERS

- A. Flexible Style: Custom fabricated composite jackets consisting of:

1. Two inches of high temperature, high density, needled fiberglass mat insulation.
2. High density mass loaded vinyl
3. Teflon impregnated fiberglass inner and outer facing with double sewn and bonded seams.
4. Extended Velcro flap on closing seams.
5. Stainless steel lacing hardware with wire twist fastener.
6. Include aluminum nameplate having embossed lettering with tag description.

- B. Manufacturer:

1. Shannon Enterprises of W.N.Y. Inc.; INSULTECH; LT450A-TT Series.

## 2.12 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.

1. Products: Subject to compliance with requirements, provide one of the products specified.

- a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
- b. Compac Corp.; 104 and 105.

- c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  2. Width: 3 inches.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.
  1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - b. Compac Corp.; 110 and 111.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
    - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
  2. Width: 3 inches.
  3. Thickness: 6.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
  1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
    - b. Compac Corp.; 130.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
    - d. Venture Tape; 1506 CW NS.
  2. Width: 2 inches.
  3. Thickness: 6 mils.
  4. Adhesion: 64 ounces force/inch in width.
  5. Elongation: 500 percent.
  6. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.
  1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    - b. Compac Corp.; 120.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
    - d. Venture Tape; 3520 CW.
  2. Width: 2 inches.
  3. Thickness: 3.7 mils.

4. Adhesion: 100 ounces force/inch in width.
  5. Elongation: 5 percent.
  6. Tensile Strength: 34 lbf/inch in width.
- E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. ITW Insulation Systems; Saran 520 Vapor Retarder Tape.
  2. Width: 3 inches.
  3. Film Thickness: 4 mils.
  4. Adhesive Thickness: 1.5 mils.
  5. Elongation at Break: 145 percent.
  6. Tensile Strength: 55 lbf/inch in width.

## 2.13 SECUREMENTS

- A. Bands:
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. PABCO-Childers Metals; ITW Insulation Systems; Pab-Bands and Fabstraps.
    - b. RPR Products, Inc.; Bands.
  2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing or closed seal.
  3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
  4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Insulation Pins and Hangers:
1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
    - a. Products: Subject to compliance with requirements, provide one of the products specified.
      - 1) AGM Industries, Inc.; CWP-1.
      - 2) GEMCO; CD.
      - 3) Midwest Fasteners, Inc.; CD.
      - 4) Nelson Stud Welding; TPA, TPC, and TPS.
  2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

- a. Products: Subject to compliance with requirements, provide one of the products specified.
  - 1) AGM Industries, Inc.; CWP-1.
  - 2) GEMCO; Cupped Head Weld Pin.
  - 3) Midwest Fasteners, Inc.; Cupped Head.
  - 4) Nelson Stud Welding; CHP.
  
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
  - a. Products: Subject to compliance with requirements, provide one of the products specified.
    - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
    - 2) GEMCO; Perforated Base.
    - 3) Midwest Fasteners, Inc.; Spindle.
  
  - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  
  - c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  
  - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
  
4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
  - a. Products: Subject to compliance with requirements, provide one of the products specified.
    - 1) GEMCO; Nylon Hangers.
    - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
  
  - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
  
  - c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
  
  - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
  
5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
  - a. Products: Subject to compliance with requirements, provide one of the products specified.
    - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
    - 2) GEMCO; Press and Peel.

- 3) Midwest Fasteners, Inc.; Self Stick.
  - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive-backed base with a peel-off protective cover.
6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- a. Products: Subject to compliance with requirements, provide one of the products specified.
    - 1) AGM Industries, Inc.; RC-150.
    - 2) GEMCO; R-150.
    - 3) Midwest Fasteners, Inc.; WA-150.
    - 4) Nelson Stud Welding; Speed Clips.
  - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- a. Manufacturers:
    - 1) GEMCO.
    - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, stainless steel.
1. Manufacturers:
    - a. ACS Industries, Inc.
    - b. C & F Wire.
    - c. PABCO-Childers Metals; ITW Insulation Systems.
    - d. RPR Products, Inc.

## 2.14 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.
- C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or 316.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
  - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

#### 3.3 COMMON INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at the 4 o'clock or 8 o'clock position on horizontal runs.

- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive as recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. For services with surface temperatures below ambient, install a continuous unbroken vapor barrier. Seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install thermal hanger insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover thermal hanger inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at the 4 o'clock or 8 o'clock position on the pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness. Where compression of insulation is possible, fabricate/install insulation per manufacturer's recommendations.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  - 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations that Are Not Fire Rated: Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations:
  - 1. Terminate ductwork insulation at angle closure of fire damper sleeves.
  - 2. Install pipe insulation continuously through penetrations of fire-rated walls and partitions.
    - a. Firestopping is specified in Division 07 Section "Through-Penetration Firestop Systems."
- E. Insulation Installation at Floor Penetrations:
  - 1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at angle closure of fire damper sleeves.
  - 2. Pipe: Install insulation continuously through floor penetrations.
    - a. Seal penetrations through fire-rated assemblies according to Division 07 Section "Through-Penetration Firestop Systems."



### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible Elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.
- E. Install removable and reusable insulation covers in accordance with fabricator's instructions, and at the following locations:
1. At valves, flanges, and expansion joints. Expansion joints shall have jacket installed in a manner to allow for replacing of joints without removing insulation cover.

### 3.6 GLASS-FIBER AND MINERAL WOOL PIPE INSULATION INSTALLATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe Flanges:

1. Install PVC fitting covers when available.
2. When PVC fitting covers are not available, install preformed pipe insulation to outer diameter of pipe flange:
  - a. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  - b. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with fiberglass or mineral wool blanket insulation as specified for system.
3. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install PVC fitting covers when available.
2. When PVC fitting covers are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install PVC fitting covers when available.
2. When PVC fitting covers are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.7 DUCT AND PLENUM INSULATION INSTALLATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions. Adhesive may be omitted from top surface of horizontal rectangular ducts.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
  - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
  - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
  - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
  - d. Do not over compress insulation during installation.
  - e. Impale insulation over pins and attach speed washers.
  - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
  - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
  - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic

applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
  6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not over compress insulation during installation.
    - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### 3.8 FIELD-APPLIED JACKET INSTALLATION

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
  1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
  2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
  3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- C. Where FSK jackets are indicated, install as follows:
  1. Draw jacket material smooth and tight.
  2. Install lap or joint strips with same material as jacket.
  3. Secure jacket to insulation with manufacturer's recommended adhesive.
  4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
  5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- D. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
  1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- E. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
- F. Where self-adhesive jackets are indicated, install according to manufacturer's instructions and details on the drawings. Overlap seams arranged to shed water.
- G. Where sound barrier jackets are indicated, install in accordance with manufacturer's instructions.
- H. Where PVDC jackets are indicated, install as follows:
  1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.

2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch-circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fish mouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

### 3.9 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, install two layers in strict accordance with manufacturer's instructions, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors in strict accordance with insulation manufacturer's to achieve same fire rating as duct.
- C. Maintain a copy of insulation manufacturer's installation instructions on site for Code Official.
- D. Where fire-rated plenum wrap system is indicated, secure to system piping to maintain a continuous UL-listed fire rating.
- E. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Through-Penetration Firestop Systems."

### 3.10 FINISHES

- A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system specified in Division 09 painting Sections.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Do not field paint aluminum or stainless-steel jackets.

END OF SECTION 200700

SECTION 202923 - VARIABLE FREQUENCY CONTROLLERS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to work of this section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 20 Section "Motors."

1.2 REFERENCES

- A. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- B. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- C. ANSI/NEMA MG 1 - Motors and Generators.

1.3 DEFINITIONS

- A. BAS: Building automation system.
- B. EMI: Electromagnetic interference.

- C. LED: Light-emitting diode.
- D. RFI: Radio-frequency interference.
- E. THD: Total harmonic disturbance.
- F. VFC: Variable frequency controller. Variable frequency controllers may also be referred to as variable speed drives, variable frequency drives, VSDs, or VFDs in other Specification Sections or on the Drawings.

#### 1.4 SUBMITTALS

- A. Product Data: For each type and rating of VFC indicated.
  - 1. Include dimensions and finishes for VFCs.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Indicating power, control and instrument wiring including ladder diagrams for field work as well as factory assembled work. Manufacturer's drawings are acceptable only when modified and supplemented to reflect project conditions. The drawings shall include:
  - 1. Overall schematic (elementary) diagram in JIC form of the entire system of power and control circuitry. Indicate interfaces with control wiring by temperature controls contractor.
  - 2. Wiring diagrams showing the wiring layout of component assemblies or systems.
  - 3. Interconnection wiring diagrams showing terminations of interconnecting conductors between component assemblies, systems, control devices, and control panels complete with conductor identification, number of conductors, conductor and conduit size.
  - 4. Sequence of operation for components, assemblies or systems.
  - 5. Dimensional data.
- C. Harmonic Analysis Report: Provide Project-specific calculations and manufacturer's statement of compliance with IEEE 519.
- D. Coordination Data for Motor-Driven Equipment: Accompanied by complete information concerning the respective motors including the following.
  - 1. Principal dimensions.
  - 2. Weights.
  - 3. Horsepower.
  - 4. Voltage, phase, frequency.
  - 5. Speed.
  - 6. Class of insulation.
  - 7. Enclosure type.
  - 8. Frame.
  - 9. Bearings including ABMA Rating Life (L-10 basis).
  - 10. Design letter.
  - 11. Manufacturer.
  - 12. Service Factor
- E. Descriptive data shall include catalogues, guaranteed performance data with efficiency and power factor indicated at 75 percent and 100 percent of rated load



and verification of conformance with other requirements of the Contract Documents. The information enumerated under NEMA MG1 Paragraph MG1-10.38, shall be arranged on one sheet for each motor.

- F. Operation and Maintenance Data: For VFCs to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
  - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Product Options for Restricted Space: Drawings indicate maximum dimensions for VFCs, including clearances between VFCs, and adjacent surfaces and other items. Refer to Division 01 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.
- E. Comply with IEEE 519 - Recommended Practice and Requirements for Harmonic Control in Electric Power Systems.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store VFCs in permanently enclosed and conditioned spaces.
- B. If stored in space that is not permanently enclosed and conditioned, remove loose packing and flammable materials from inside controllers and install temporary electric heating, with at least 250 W per controller.

#### 1.7 COORDINATION

- A. For Electrical Work Provided under Division 20, 22, and 23 Specifications: Furnish UL Listed components, in accordance with Division 26 Specifications and applicable NEMA and NEC (ANSI C 1) requirements. Provide wiring, external to electrical enclosures, in conduit.
- B. Provide Electrical Work required for the operation of components and assemblies provided as part of the Work under Division 20, 22, and 23 Specifications.
- C. Coordinate with temperature controls contractor for interfaces with temperature controls wiring.
- D. Mount line voltage (120 VAC) control components specified as part of the Work under Division 20, 22, and 23 Specifications.

- E. Refer to ELECTRICAL DRAWINGS and Division 26 Specifications for specified information regarding provisions for the arrangement of electrical circuits and components and for interface with Work specified under Division 20, 22, and 23 Specifications.
- F. The mechanical contractor shall furnish and install the variable frequency controller. Electrical trades shall make power connections to both load and line side of the VFC.

## 1.8 WARRANTY

- A. Warranty shall be 36 months from date of project acceptance. The warranty shall include all parts, labor, travel time and expenses.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Electrical Power Supply Characteristics: 480 volts, 3 phase, 60 hertz (Hz).
- B. Controller(s) shall be suitable for use with standard NEMA-B squirrel-cage induction motor(s) having a 1.15 Service Factor. At any time in the future, it shall be possible to substitute standard motor (equivalent horsepower, voltage and RPM) in the field.

### 2.2 VARIABLE FREQUENCY CONTROLLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
  - 1. ABB Group.
  - 2. Danfoss.
  - 3. Eaton Corporation.
  - 4. General Electric.
  - 5. Hitachi America, Ltd.
  - 6. Johnson Controls Incorporated (Private labeled ABB).
  - 7. Mitsubishi Electric Automation, Inc.
  - 8. Square D; Schneider Electric.
  - 9. Toshiba International Corporation.
  - 10. Yaskawa Electric America, Inc.
- B. Provide variable frequency controllers as scheduled including coasting motor restart, and step over frequency.
  - 1. The ratio of the total impedance to common system impedance shall be greater than or equal to 10.
  - 2. The voltage notch area shall be limited to 16-400 volt microseconds.
  - 3. The total harmonic disturbance (THD) as a result of voltage notching shall be 3 percent or less at the point of common coupling.
  - 4. The THD as a result of current notching shall be 100 percent or less at the point of common coupling.

- C. Provide 5 percent AC input line reactors sized appropriate for each current rating variable frequency controller.
- D. Variable frequency controller (VFC) shall comply with all applicable provisions of the National Electrical Code.
- E. Line side of the VFC shall have a displacement power factor of 0.95 or greater when motor is operating at 50 to 100 percent motor speed.
- F. VFC shall have efficiency greater than 85 percent when motor is operating at 50 to 100 percent motor speed.
- G. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- H. Unit Operating Requirements:
  - 1. Input AC Voltage Tolerance: Plus 10 and minus 5 percent of VFC input voltage rating.
  - 2. Input Frequency Tolerance: Plus 2 percent of VFC frequency rating.
- I. Each variable frequency controller shall consist of an adjustable frequency converter which shall convert input power into an adjustable frequency output in an ambient temperature of zero to 40 deg C. Output power shall be suitable capacity and waveform to provide stepless speed control of the specified horsepower motor throughout the required speed range under variable torque load not exceeding the motor's full-load rating.
- J. Provide fault detection and trip circuits to protect itself and the connected motor against line voltage transients, power line under voltage, output overvoltage and overcurrent. A disconnect with padlockable door interlocked external handle shall be supplied to disconnect the incoming power.
  - 1. Minimum short circuit design shall be in accordance with Electrical Contractor provided short circuit analysis.
- K. Criteria in Paragraph B shall be met without the use of isolation transformers. Variable frequency controller will be accepted only if criteria can be met without isolation transformers.
- L. Minimum output frequency shall be the lowest frequency at which the connected motor can be operated without overheating.
- M. Inverter shall contain current limiting circuitry, adjustable to 100 percent of motor full-load current to provide soft start, acceleration, and running without exceeding motor rated current. The current limit circuit shall be of the type for variable torque load, which acts to diminish output frequency while limiting, without directly causing shutdown.
- N. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts. For safety, drive shall shut down and require manual reset and restart if automatic reset/restart function is not successful within three attempts.

- O. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.
- P. Isolate signal circuits from the power circuits and design to accept a speed signal from a remote process controller in the automatic mode and from the speed control potentiometer in the manual mode. A door-mounted switch shall provide mode selection. The selected signal shall control the motor speed between the adjustable minimum and maximum speed settings. Maximum speed shall be field adjustable to 100 percent of rated speed. The speed signal shall follow a linear time ramp, adjustable from 4-20 seconds to provide acceleration from zero to minimum speed. When minimum speed is reached, the speed signal shall follow the linear time ramp for acceleration and deceleration control.
- Q. Mount the adjustable frequency inverter and other electrical components that provide the operation specified in a NEMA 1 enclosure. Equipment shall have external heat sinks, or air filters on all vents. The enclosure shall have hinged front access doors with latch. Cabinet to cabinet interconnecting wiring shall be factory dressed, tagged and harnessed, and shipped with one end attached.
- R. Controller shall have the ability to step-over certain set frequencies that may cause a system to resonate. The controller shall have at least two manually set points of frequency in which the controller shall step-over during operation.
- S. Operating and monitoring devices for the inverter shall be door mounted and shall include the following:
  - 1. Manual Speed Control to set speed in the hand (manual) mode.
  - 2. Speed indicating meter, either in revolutions per minute, proportional to the applied frequency and voltage to indicate speed of the converter-powered motor or frequency (hertz).
  - 3. VFC "fault/reset" pilot light pushbutton combination with dry contact for external alarm. Fault alarm shall not actuate upon normal shutdown.
  - 4. Inverter "control power" indicator.
  - 5. Motor "running" indicator and two dry contacts that close when motor is running.
  - 6. Output current meter calibrated in "AC amps."
  - 7. Operating selector switches and indicating light to perform the following functions:
    - a. One hand-off-auto switch for the VFC and bypass starter with indicating lights (red-running, green-energized). In hand position, unit (VFC or bypass starter) shall start. In auto position, unit (VFC or bypass starter) shall start when remote dry contact is closed.
    - b. Unit shall be capable of being padlocked in the off position.
  - 8. Output voltmeter (0 - 600 VAC) (analog or digital).
- T. The VFC is to be provided with isolated 4-20 mA DC output signals proportional to speed, current and voltage for connection by others.
- U. The VFC shall be provided with the ability to communicate (monitoring) through RS485 connector.

- V. Remote speed control shall be 4-20 mA control signal from a remote controller.
- W. Variable frequency controller shall not cause motor to produce noise levels exceeding 80 dBA measured at a distance of 3 feet from the motor. If noise level of motor exceeds this amount, the contractor shall be responsible for correcting the problem.
- X. Provide connection points for system safety controls such as smoke detectors, freeze stats, damper end switches, etc. as shown on mechanical temperature control drawings. Opening of a contact on safety controls wired to the drive shall shut down the motor.
- Y. Provide in each VFC, a relay, that upon loss of the automatic speed control signal shall:
  - 1. Automatically set the motor rpm to half speed. This loss of signal relay shall be manually adjustable to be able to set default speed to some other value than half speed if required later in the field.
- Z. Coordinate with the Temperature Controls Contractor for the interface of control wiring to the drive as required to meet the requirements of the temperature control drawings. Drive shall be furnished with internal control wiring configured in the factory to allow single connections of field wiring to terminal blocks in the drive by the Temperature Controls Contractor.
- AA. All indicating lights shall be push to test or LED.

## 2.3 SOURCE QUALITY CONTROL

- A. Factory Tests: The controller shall be subject to, but not limited to, the following quality assurance controls, procedures and tests:
  - 1. Power transistors, SCRs and diodes shall be tested to ensure correct function and highest reliability.
  - 2. All printed circuit boards shall be tested at 50 deg C for 50 hours. The VFC manufacturer shall provide certification that the tests have been completed.
  - 3. Every controller will be functionally tested with a motor to ensure that if the drive is started up according to the instruction manual provided, the unit will run properly.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, surfaces, and substrates to receive VFCs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance.
- B. Examine VFC before installation. Reject VFCs that are wet, moisture damaged, or mold damaged.

- C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install and adjust materials and equipment in accordance with the manufacturer's instructions.
- B. Obtain the manufacturer's instructions for materials and equipment provided under the Contract in detail necessary to comply with the requirements of the Contract Documents.
- C. If unit is free standing, provide a concrete housekeeping pad.

### 3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Upon completion of each installation, conduct complete acceptance tests in the presence of duly notified authorities having jurisdiction and the Owner to demonstrate component, assembly or system performance in accordance with the requirements of the Contract Documents.
- C. In the event that a test demonstrates that a component assembly or system performance is deficient, the Owner may require additional tests after corrective work.
- D. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.
- E. Component assembly and systems acceptance is predicated upon completion of specified work and receipt by the Owner of data specified under "Submittals."
- F. Electrical testing of motors is specified in Division 20 Section "Motors."

### 3.4 ADJUSTING

- A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.
- B. Set the taps on reduced-voltage autotransformer controllers.
- C. Set field-adjustable circuit-breaker trip ranges.
- D. Set field-adjustable pressure switches.

### 3.5 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.
- B. Replace VFCs whose interiors have been exposed to water or other liquids prior to Substantial Completion.

### 3.6 DEMONSTRATION

- A. The VFC supplier/support group shall provide the following additional services:
  - 1. On-site training of customer personnel in operation and maintenance of variable frequency controllers.
  - 2. Provide four copies of a troubleshooting manual and factory training manuals to help the building operator determine what steps must be taken to correct any problem that may exist in the system.
  - 3. Coordinate enrollment of customer personnel in factory-held service schools.

END OF SECTION 202923

SECTION 211100 - FIRE-SUPPRESSION SYSTEM

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Provisions of Division 20 Section "Mechanical General Requirements" apply to this Section.
- C. Related Sections include the following:



1. Division 10 Section "Fire-Protection Specialties" for cabinets and fire extinguishers.
2. Division 20 Section "Basic Mechanical Materials and Methods."
3. Division 20 Section "Hangers and Supports."
4. Division 28 Section "Fire Alarm" for alarm devices not specified in this Section.

## 1.2 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. Working Plans: Documents, including drawings, calculations, and material specifications prepared according to NFPA 13 and NFPA 14 for obtaining approval from authorities having jurisdiction.

## 1.3 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

## 1.4 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.
- B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction.
  1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
  2. Sprinkler Occupancy Hazard Classifications, for bidding purposes, as follows:
    - a. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
    - b. General Storage Areas: Ordinary Hazard, Group 1.
    - c. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
    - d. Office and Public Areas: Light Hazard.
  3. Minimum Density for Automatic-Sprinkler Piping Design:
    - a. Light-Hazard Occupancy: 0.10 gpm/sq. ft. over 1500-sq. ft. area.
    - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
  4. Maximum Protection Area per Sprinkler:
    - a. Office Spaces: 120 sq. ft.
    - b. Storage Areas: 130 sq. ft.
    - c. Mechanical Equipment Rooms: 130 sq. ft.
    - d. Electrical Equipment Rooms: 130 sq. ft.

- e. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.
- 5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:
  - a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
  - b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.
- D. Water velocity in the piping system shall not exceed the following:
  - 1. Underground mains: 16 ft./sec.
  - 2. Aboveground mains: 32 ft./sec.
  - 3. Sprinkler branch lines: 24 ft./sec.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Wiring Diagrams: For power, signal, and control wiring.
- B. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Domestic water piping.
  - 2. HVAC hydronic piping.
  - 3. Items penetrating finished ceiling include the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
- D. Qualification Data: For qualified Installer.
- E. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable.
  - 1. Sprinklers shall be referred to on drawings, submittals, and other documentation, by the sprinkler identification number (SIN) or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.
- F. Fire-hydrant flow test report.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping"
- B. Field quality-control reports.
- C. Operation and Maintenance Data: For sprinkler specialties to include in operation and maintenance manuals.

#### 1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
    - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
  - B. The provisions and requirements of the NFPA and the Owner's insurance underwriter constitute mandatory minimum requirements for the work of this Section.
  - C. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:
    - 1. NFPA 13, "Installation of Sprinkler Systems."
  - D. Grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer.

#### 1.9 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

#### 1.10 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 STANDARD-WEIGHT BLACK STEEL PIPE AND FITTINGS

- A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed threaded ends, and with factory applied antimicrobial coating on inner wall of pipe.
1. Cast-Iron Threaded Flanges: ASME B16.1.
  2. Malleable-Iron Threaded Fittings: ASME B16.3.
  3. Gray-Iron Threaded Fittings: ASME B16.4.
  4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe. Include ends matching joining method.
  5. Steel Threaded Couplings: ASTM A 865.
- B. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, and with factory applied antimicrobial coating on inner wall of pipe.
1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
  2. Steel Flanges and Flanged Fittings: ASME B16.5.
- C. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed, square-cut- or roll- grooved ends, and with factory applied antimicrobial coating on inner wall of pipe.
1. Grooved-Joint Piping Systems:
    - a. Manufacturers:
      - 1) Anvil; Model 7401; ASC Engineered Solutions.
      - 2) Tyco Fire Protection Products by Johnson Controls Company; Grinnell G-Fire.
      - 3) Victaulic Co. of America; Style 005H, 009N, or 107N.
    - b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
    - c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, rubber gasket listed for use with housing, and steel bolts and nuts.

### 2.3 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping.
- B. Sprinkler Drain and Alarm Test Fittings: Cast-bronze or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.
  - 1. Manufacturers:
    - a. Tyco Fire Protection Products by Johnson Controls Company.
    - b. Fire-End and Croker Corp.
    - c. Viking Corp.
    - d. Victaulic Co. of America; Style 720 TestMaster II.
- C. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.
  - 1. Manufacturers:
    - a. Elkhart Brass Mfg. Co., Inc.
- D. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.
  - 1. Manufacturers:
    - a. AGF Manufacturing Co.
    - b. G/J Innovations, Inc.
    - c. Triple R Specialty of Ajax, Inc.
    - d. Tyco Fire Protection Products by Johnson Controls Company.
- E. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.
  - 1. Manufacturers:
    - a. CECA, LLC.
    - b. Merit.

### 2.4 LISTED FIRE-PROTECTION VALVES

- A. Valves: UL listed or FMG approved.
  - 1. Valves shall have 175-psig minimum pressure rating.
- B. Ball Valves: Comply with UL 1091, except with ball instead of disc.
  - 1. NPS 1-1/2 and Smaller: Bronze body with threaded ends.
  - 2. NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
  - 3. NPS 3: Ductile-iron body with grooved ends.
  - 4. Manufacturers:
    - a. NIBCO.
    - b. Victaulic Co. of America.

- C. Butterfly Valves: UL 1091.
  - 1. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.
    - a. Manufacturers:
      - 1) McWane, Inc.; Kennedy Valve Div.
      - 2) Mueller Company; ASC Engineered Solutions.
      - 3) NIBCO.
      - 4) Tyco Fire Protection Products by Johnson Controls Company.
      - 5) Victaulic Co. of America; Series 705.
- D. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.
  - 1. Manufacturers:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Valves.
    - d. Hammond Valve.
    - e. McWane, Inc.; Kennedy Valve Div.
    - f. Mueller Company; ASC Engineered Solutions.
    - g. NIBCO.
    - h. Tyco Fire Protection Products by Johnson Controls.
    - i. Victaulic Co. of America.
    - j. Watts Water Technologies, Inc.; Watts Regulator Co.
- E. Gate Valves: UL 262, OS&Y type.
  - 1. NPS 2 and Smaller: Bronze body with threaded ends.
    - a. Manufacturers:
      - 1) Crane Co.; Crane Valve Group; Crane Valves.
      - 2) Hammond Valve.
      - 3) NIBCO.
  - 2. NPS 2-1/2 and Larger: Cast or ductile -iron body with flanged or grooved ends.
    - a. Manufacturers:
      - 1) McWane, Inc.; Clow Valve Co.
      - 2) Crane Co.; Crane Valve Group; Crane Valves.
      - 3) Crane Co.; Crane Valve Group; Jenkins Valves.
      - 4) Hammond Valve.
      - 5) Milwaukee Valve Company.
      - 6) Mueller Company; ASC Engineered Solutions.
      - 7) NIBCO.
      - 8) Victaulic Co. of America: Series 771.

## 2.5 UNLISTED GENERAL-DUTY VALVES

- A. Ball Valves NPS 2 and Smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig minimum CWP rating, blowout-proof stem, and threaded ends.
- B. Check Valves NPS 2 and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.
- C. Gate Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.
- D. Globe Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

## 2.6 AUTOMATIC (BALL DRIP) DRAIN VALVES

- A. General:
  - 1. Standard: UL 1726.
  - 2. Pressure Rating: 175 psig minimum.
  - 3. Type: Automatic draining, ball check.
  - 4. Size: NPS 3/4.
  - 5. End Connections: Threaded.
- B. Manufacturer:
  - 1. Reliable Automatic Sprinkler Co., Inc.
  - 2. Tyco Fire Protection Products by Johnson Controls Company.

## 2.7 SPRINKLERS

- A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating.
- B. Manufacturers:
  - 1. Reliable Automatic Sprinkler Co., Inc.
  - 2. Tyco Fire Protection Products by Johnson Controls Company.
  - 3. Victaulic Co. of America.
  - 4. Viking Corp.
- C. Automatic Sprinklers:
  - 1. With heat-responsive glass bulb element complying with the following:
    - a. UL 199, for nonresidential applications.
- D. Sprinkler Types and Categories: Nominal 1/2-inch orifice for 165 deg F "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
- E. Sprinkler types, features, and options as follows:
  - 1. Concealed ceiling sprinklers, including cover plate.

2. Extended-coverage sprinklers.
  3. Pendent sprinklers.
  4. Pendent, dry-type sprinklers.
  5. Quick-response sprinklers.
  6. Recessed sprinklers, including escutcheon.
  7. Sidewall sprinklers.
  8. Concealed sidewall sprinklers, including cover plate.
  9. Upright sprinklers.
- F. Sprinkler Finishes: Chrome plated, bronze, and painted.
- G. Special Coatings: Wax, lead, and corrosion-resistant paint.
- H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers. Escutcheons listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.
1. Ceiling Mounting: Chrome-plated steel, 2-piece, with 3/4-inch vertical adjustment.
  2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- I. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler. Sprinkler guards listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.

## 2.8 PRESSURE GAGES

- A. Manufacturers:
1. AMETEK, Inc.; U.S. Gauge.
  2. Ashcroft Inc.
  3. Marsh Bellofram.
  4. Viking Corp.
  5. Weiss Instruments, Inc.
- B. Description: UL 393, 3-1/2- to 4-1/2-inch diameter, dial pressure gage with range of 0 to 250 psig minimum
1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.
- B. Report test results promptly and in writing.



3.2 EARTHWORK

- A. Refer to Division 31 Section "Earthwork" for excavating, trenching, and backfilling.

3.3 EXAMINATION

- A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.
- B. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 PIPING APPLICATIONS, GENERAL

- A. Flanges, flanged fittings, unions, nipples, grooved-joint couplings, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

3.5 SPRINKLER SYSTEM PIPING APPLICATIONS

- A. Wet-Pipe Sprinklers: Use the following:

Pipe Type	<u>1 ½" &amp; Smaller</u>	<u>2"</u>	<u>2 ½" - 3 ½"</u>	<u>4"</u>	<u>5" - 6"</u>
Standard weight steel, threaded fittings	YES	YES	YES	YES	NO
Standard weight steel, grooved fittings	NO	NO	YES	YES	YES
Standard weight steel, welded fittings	NO	YES	YES	YES	YES

3.6 VALVE APPLICATIONS

- A. The following requirements apply:
  1. Listed Fire-Protection Valves: UL listed or FMG approved for applications where required by NFPA 13.
    - a. Shutoff Duty: Use ball, butterfly, or gate valves.
  2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13.
    - a. Shutoff Duty: Use ball, butterfly, or gate valves.
    - b. Throttling Duty: Use ball or globe valves.

### 3.7 JOINT CONSTRUCTION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.
- C. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
  - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- D. Use of saddle style tees is not acceptable.
- E. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.
  - 1. All grooved couplings, fittings, gaskets, valves, and specialties shall be the product of a single manufacturer.
  - 2. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
  - 3. Dry-Pipe Systems: Use fittings and gaskets listed for dry-pipe service.

### 3.8 PIPING INSTALLATION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- B. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- C. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
- D. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.
- E. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
- F. Install sprinkler piping with drains for complete system drainage.
- G. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- H. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- I. Install alarm devices in piping systems.
- J. Hangers and Supports: Comply with NFPA 13 for hanger materials.

1. Install standpipe system piping according to NFPA 14.
  2. Install sprinkler system piping according to NFPA 13, except use of "C" clamps, or beam clamps of "C" pattern, or any modification thereof, is prohibited for supporting pipes larger than NPS 2-1/2.
  3. Refer to Division 20 Section "Hangers and Supports" for additional requirements.
- K. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- L. Fill wet-pipe sprinkler system piping with water.

### 3.9 VALVE INSTALLATION

- A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.

### 3.10 SPRINKLER APPLICATIONS

- A. Use the following sprinkler types:
1. Rooms without Ceilings: Upright sprinklers.
  2. Rooms with Suspended Ceilings: Concealed sprinklers Flush sprinklers.
  3. Wall Mounting: Sidewall sprinklers.
  4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated.
  5. Sprinkler Finishes:
    - a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes; white polyester finish in natatoriums.
    - b. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
    - c. Flush Sprinklers: Bright chrome, with painted white escutcheon.
    - d. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
  6. Sprinkler Guards: For exposed sprinkler heads subject to damage.

### 3.11 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels and tiles.
- B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

### 3.12 CONNECTIONS

- A. Install piping adjacent to equipment to allow service and maintenance.
- B. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping. Refer to Division 22 Section "Domestic Water Piping Specialties" for backflow preventers.
- C. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.
- D. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
- E. Electrical Connections: Power wiring and fire alarm wiring are specified in Division 26.
- F. Connect alarm devices to fire alarm.
- G. Ground equipment according to Division 26 Section "Grounding and Bonding."
- H. Connect wiring according to Division 26 Section "Conductors and Cables."
- I. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.13 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and in Division 20 Section "Mechanical Identification."

### 3.14 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  - 4. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
  - 5. Verify that equipment hose threads are same as local fire department equipment.
  - 6. Test each backflow prevention device according to authorities having jurisdiction and the device's reference standard.
- B. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
- C. Verify that specified tests of piping are complete.

- D. Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.
- E. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.
- F. Verify that potable-water supplies have correct types of backflow preventers.
- G. Energize circuits to electrical equipment and devices.
- H. Start and run excess-pressure pumps.
- I. Adjust operating controls and pressure settings.
- J. Coordinate with fire alarm tests. Operate as required.
- K. Report test results promptly and in writing to Architect and authorities having jurisdiction.

### 3.15 CLEANING AND PROTECTION

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.
- C. Protect sprinklers from damage until Substantial Completion.

### 3.16 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

END OF SECTION 211100

SECTION 220523 - GENERAL DUTY VALVES FOR PLUMBING

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 21 fire-suppression piping Section for fire-protection valves.
  - 2. Division 20 Section "Mechanical Identification" for valve tags and charts.
  - 3. Division 22 Piping Sections for specialty valves applicable to those Sections only.
  - 4. Division 23 Section "General-Duty Valves for HVAC" for HVAC valves.
  - 5. Division 23 Section "Temperature Controls" for control valves and actuators.

1.2 SUMMARY

- A. This Section includes valves for general plumbing applications. Refer to piping Sections for specialty valve applications.

1.3 DEFINITIONS

- A. The following are standard abbreviations for valves:
  - 1. CWP: Cold working pressure.
  - 2. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 3. NBR: Acrylonitrile-butadiene rubber.

4. NRS: Nonrising stem.
5. OS&Y: Outside screw and yoke.
6. PTFE: Polytetrafluoroethylene plastic.
7. RPTFE: Reinforced polytetrafluoroethylene plastic.
8. SWP: Steam working pressure.
9. TFE: Tetrafluoroethylene plastic.
10. WOG: Water, oil, and gas.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.
  1. Certification that products for use in potable water systems comply with NSF 61 and NSF 372.

#### 1.5 QUALITY ASSURANCE

- A. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.
- B. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  1. Protect internal parts against rust and corrosion.
  2. Protect threads, flange faces, grooves, and weld ends.
  3. Set angle, gate, and globe valves closed to prevent rattling.
  4. Set ball and plug valves open to minimize exposure of functional surfaces.
  5. Set butterfly valves closed or slightly open.
  6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  1. Maintain valve end protection.
  2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

## PART 2 - PRODUCTS

### 2.1 VALVES, GENERAL

- A. Isolation valves are scheduled on the Drawings. For other general plumbing valve applications, use the following:
  - 1. Shutoff Service: Ball, butterfly, or gate valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- D. For valves not indicated in the Application Schedules, select valves with the following end connections:
  - 1. For Copper Tubing, NPS 2 and Smaller: Solder-joint or threaded ends, except provide valves with threaded ends for condenser water, heating hot water, steam, and steam condensate services.
  - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged, solder-joint, or threaded ends.
  - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
  - 4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
- E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted unless otherwise noted.
- F. Wetted surfaces of valves contacted by consumable water shall contain not more than 0.25 percent weighted average lead content.
  - 1. Exceptions:
    - a. Valves in pumped sanitary systems.
    - b. Valves in pumped storm systems.
    - c. Drain valves.
    - d. Valves in general air or vacuum systems.
    - e. Valves in irrigation systems.
    - f. Valves in non-potable water systems.
    - g. Valves in other plumbing systems not intended for human consumption.
- G. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- H. Valve Actuators:
  - 1. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
  - 2. Handwheel: For valves other than quarter-turn types.
- I. Extended Valve Stems: On insulated valves.
- J. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.



- K. Valve Grooved Ends: AWWA C606.
- L. Solder Joint: With sockets according to ASME B16.18.
  - 1. Caution: Disassemble valves when soldering, as recommended by the manufacturer, to prevent damage to internal parts.
- M. Threaded: With threads according to ASME B1.20.1.
- N. Valve Bypass and Drain Connections: MSS SP-45.

## 2.2 BRONZE BALL VALVES

- A. Bronze Ball Valves, General: MSS SP-110 and have bronze body complying with ASTM B 584, except for Class 250 which shall comply with ASTM B 61, full-depth ASME B1.20.1 threaded or solder ends, and blowout-proof stems.
- B. Two-Piece, Regular Port Bronze Ball Valves with Stainless-Steel Trim: Type 316 stainless-steel ball and stem, reinforced TFE seats, blow-out-proof stem, with adjustable stem packing, soldered or threaded ends; and 150 psig SWP and 600-psig CWP ratings.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; by Conbraco Industries, Inc.; Series 70LF-140/240.
    - b. Hammond Valve.
    - c. Kitz Corporation; Kitz Valves.
    - d. Milwaukee Valve Company; Model UPBA100S/150S.
    - e. NIBCO INC.; Models S-580-70-66-LF/T-580-70-66-LF.
    - f. Watts Water Technologies, Inc.

## 2.3 GENERAL SERVICE BUTTERFLY VALVES

- A. General: MSS SP-67, for bubble-tight shutoff, extended-neck for insulation, disc and lining suitable for potable water, unless otherwise indicated, and with the following features:
  - 1. Full lug, and grooved valves shall be suitable for bi-directional dead end service at full rated pressure without the use or need of a downstream flange.
  - 2. Valve sizes NPS 2 through NPS 6 shall have lever lock operator; valve sizes NPS 8 and larger shall have weatherproof gear operator.

## 2.4 DRAIN VALVES

- A. Ball-Valve-Type, Hose-End Drain Valves:
  - 1. Bronze ball valve as specified in this Section. Lead free construction is not required.
  - 2. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

## 2.5 CHAINWHEEL ACTUATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Babbitt Steam Specialty Co.
  - 2. Roto Hammer Industries, Inc.
- B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
  - 1. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve.
  - 2. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
  - 3. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

## 2.6 SOURCE QUALITY CONTROL

- A. Identification: Factory label or color coding to identify lead free valves.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 20 and 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe. Butterfly valves shall be installed with stem horizontal to allow support for the disc and the cleaning action of the disc.
- E. Install valves in position to allow full stem movement.
- F. Install chainwheel operators on valves NPS 4 and larger and more than 84 inches above floor. Extend chains to 60 inches above finished floor elevation.
- G. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.
  - 2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
  - 3. Lift Check Valves: With stem upright and plumb.

### 3.3 JOINT CONSTRUCTION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

### 3.4 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 220523

SECTION 221116 - DOMESTIC WATER PIPING

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods" for materials and methods common to mechanical piping systems.
  - 3. Division 20 Section "Hangers and Supports."
  - 4. Division 20 Section "Meters and Gages" for thermometers, pressure gages, and fittings.
  - 5. Division 22 Section "Plumbing Valves" for general duty plumbing valves.
  - 6. Division 22 Section "Domestic Water Piping Specialties" for water distribution piping specialties.

1.2 SUMMARY

- A. This Section includes domestic water piping inside the building.

1.3 SYSTEMS DESCRIPTION

- A. Potable and non-potable domestic water piping system materials are scheduled on the Drawing.

- B. Refer to Application Schedules on the Drawings for valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Use general service butterfly valves or cast-iron globe valves with flanged ends for piping NPS 2-1/2 and larger.
  - 2. PP Composite Pressure Piping: PP ball valves may be used for piping NPS 6 and smaller. Use general service butterfly valves for piping NPS 8 and larger.
- C. Transition and special fittings with pressure ratings at least equal to piping rating may be used unless otherwise indicated.

#### 1.4 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Water Samples: Specified in Part 3 "Cleaning" Article.
- C. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
  - 1. Domestic water piping.
  - 2. HVAC hydronic piping.
- D. Field quality-control test reports.

#### 1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- C. Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.
- D. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," and NSF 372 Drinking Water System Components - Lead Content for potable domestic water piping and components.
- E. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be as recommended by the manufacturer of the grooved components.

#### 1.6 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and

then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Construction Manager's written permission.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 PIPING MATERIALS

A. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

### 2.3 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

B. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

## 2.4 VALVES

- A. General-duty plumbing valves; and drain valves are specified in Division 22 Section "Plumbing Valves."
- B. Balancing valves are specified in Division 22 Section "Domestic Water Piping Specialties."

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEM INSTALLATION

- A. Basic piping installation requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
  - 1. Install hose-end drain valves at low points in water mains, risers, and branches.
  - 2. Install stop-and-waste drain valves where indicated.
- D. Install domestic water piping level without pitch and plumb.

### 3.2 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- B. PEX Piping Joints: Join according to ASTM F 1807.

### 3.3 HANGER AND SUPPORT INSTALLATION

- A. Pipe hanger and support devices are specified in Division 20 Section "Hangers and Supports." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer than 100 Feet: MSS Type 49, spring cushion rolls, if indicated.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 20 Section "Hangers and Supports."

- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for drawn-temper copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60-inches with 3/8-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Soft copper tube: Continuous support using v-shaped plastic pipe channel, maximum hanger spacing 8 feet with 3/8-inch rod.
- H. Alternate support for copper tubing NPS 3/4 and smaller: Continuous support using v-shaped plastic pipe channel, maximum hanger spacing 8 feet with 3/8-inch rod.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.4 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect domestic water piping to existing domestic water distribution piping. Use dielectric fitting if connection dissimilar metals. Refer to Application Schedule on the Drawings and Division 20 Section "Basic Mechanical Materials and Methods" for dielectric fittings.
- C. Install piping adjacent to equipment and machines to allow service and maintenance.
- D. Connect domestic water piping to the following:
  - 1. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."

### 3.5 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
  - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
  - 2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
    - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.



3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 150 psig. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

### 3.6 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
  - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
  - b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.7 CLEANING AND DISINFECTION

- A. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.
- B. Clean and disinfect potable domestic water piping as follows:
  - 1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
  - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 20 Section "Meters and Gages" for thermometers, pressure gages, and flow meters in domestic water piping.
  - 4. Division 22 Section "Domestic Water Piping" for water meters.
  - 5. Division 22 Section "Emergency Plumbing Fixtures" for water tempering equipment.

1.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Field quality-control test reports.
- C. Flow Reports and Settings: For calibrated balancing valves.
- D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- B. NSF Compliance:
  - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
  - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
  - 3. Comply with NSF 372, "Drinking Water System Components - Lead Content" for components with wetted surfaces in contact with potable water.

### PART 2 - PRODUCTS

#### 2.1 BACKFLOW PREVENTERS

- A. Intermediate Atmospheric-Vent Backflow Preventers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; Conbraco Industries, Inc.
    - b. FEBCO; a Division of Watts Water Technologies, Inc.
    - c. Watts Water Technologies, Inc.; Watts Regulator Co.
    - d. Zurn Plumbing Products Group; Wilkins Div.
  - 2. Standard: ASSE 1012.
  - 3. Operation: Continuous-pressure applications.
  - 4. Body: Bronze.
  - 5. End Connections: Union, solder joint.
  - 6. Finish: Chrome plated.
- B. Reduced-Pressure-Principle Backflow Preventers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; Conbraco Industries, Inc.
    - b. FEBCO; a Division of Watts Water Technologies, Inc.
    - c. Watts Water Technologies, Inc.; Ames Fire & Waterworks.
    - d. Watts Water Technologies, Inc.; Watts Regulator Co.
    - e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Size and Capacities: As scheduled on the drawings.
6. Body: Bronze for NPS 2 and smaller; cast-iron or ductile-iron, with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:
  - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
  - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
  - c. Y-Pattern strainer and soft-seated check valve.

C. Double-Check Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Apollo Valves; Conbraco Industries, Inc.
  - b. FEBCO; a Division of Watts Water Technologies, Inc.
  - c. Watts Water Technologies, Inc.; Ames Fire & Waterworks.
  - d. Watts Water Technologies, Inc.; Watts Regulator Co.
  - e. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Size and Capacities: As scheduled on the drawings.
6. Body: Bronze for NPS 2 and smaller; cast-iron or ductile-iron, with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:
  - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

D. Beverage-Dispensing-Equipment Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Apollo Valves; Conbraco Industries, Inc.
  - b. Watts Water Technologies, Inc.; Watts Regulator Co.
  - c. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1022.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.

5. Body: Stainless steel or Acetal plastic.
6. End Connections: Threaded.

E. Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Apollo Valves; Conbraco Industries, Inc.
  - b. FEBCO; a Division of Watts Water Technologies, Inc.
  - c. Watts Water Technologies, Inc.; Watts Regulator Co.
  - d. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1024.
3. Operation: Continuous-pressure applications.
4. Size: As indicated on the drawings.
5. Body: Bronze with union inlet.

F. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Watts Water Technologies, Inc.; Watts Regulator Co.
2. Standard: ASSE 1032.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.
5. Body: Stainless steel.
6. End Connections: Threaded.

G. Hose-Connection Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Apollo Valves; Conbraco Industries, Inc.
  - b. Watts Water Technologies, Inc.; Watts Regulator Co.
  - c. Woodford Manufacturing Company.
2. Standard: ASSE 1052.
3. Operation: Up to 10-foot head of water back pressure.
4. Inlet Size: NPS 1/2 or NPS 3/4.
5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
6. Capacity: At least 3-gpm flow.

## 2.2 BALANCING VALVES

A. Calibrated Balancing Valves NPS 1/2:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. Armstrong Pumps, Inc.

- c. Apollo Valves; by Conbraco Industries, Inc.
  - d. Bell & Gossett; Xylem Inc.
  - e. Flo Fab Inc.
  - f. Flow Design Inc.
  - g. Griswold Controls.
  - h. NIBCO INC.
  - i. IMI Indoor Climate; Tour & Andersson.
  - j. Taco, Inc.
  - k. Watts Water Technologies, Inc.; Watts Regulator Co.
2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
  3. Body: Dezincification resistant brass, or bronze.
  4. Minimum Flow Rate: 0.3 gpm.
  5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Calibrated Balancing Valves NPS 3/4 to NPS 2:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. Armstrong Pumps, Inc.
  - c. Apollo Valves; by Conbraco Industries, Inc.
  - d. Bell & Gossett; Xylem Inc.
  - e. Flo Fab Inc.
  - f. Flow Design Inc.
  - g. Griswold Controls.
  - h. NIBCO INC.
  - i. IMI Indoor Climate; Tour & Andersson.
  - j. Taco, Inc.
  - k. Watts Water Technologies, Inc.; Watts Regulator Co.
2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
3. Body: Dezincification resistant brass, or bronze.
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.3 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Acorn Controls; Morris Group International; ST70.
  - b. Apollo Valves; Conbraco Industries, Inc.; Model MVD (34D Series).
  - c. Bradley Corporation.
  - d. Lawler Manufacturing Company, Inc.
  - e. Leonard Valve Company; Series 170-LF and 270-LF.
  - f. Watts Water Technologies, Inc.; Powers Division; Hydroguard Series LFe480, LFG480, and LFLM495.
  - g. Watts Water Technologies, Inc.; Watts Regulator Co.

- h. Zurn Plumbing Products Group; Wilkins Div.
  - 2. Standard: ASSE 1070.
  - 3. Pressure Rating: 125 psig.
  - 4. Type: Thermostatically controlled water mixing valve.
  - 5. Material: Bronze body with corrosion-resistant interior components.
  - 6. Connections: 1/2-inch union or 3/8-inch compression; with integral check valves.
  - 7. Accessories: Adjustable temperature-control knob.
  - 8. Outlet Temperature Range: Adjustable from 85 deg F to 120 deg F. Set at 105 deg F.
  - 9. Minimum Flow Rate: 0.5 gpm.
  - 10. Valve Finish: Chrome plated.

## 2.4 STRAINERS FOR DOMESTIC WATER PIPING

### A. Y-Pattern Strainers:

- 1. Manufacturers:
  - a. Apollo Valves; Conbraco Industries, Inc.
  - b. Keckley.
  - c. Metraflex.
  - d. Mueller Steam Specialty.
  - e. NIBCO, Inc.
  - f. Spence.
  - g. SSI Equipment, Inc.
  - h. Watts Water Technologies, Inc.
  - i. Yarway.
- 2. CWP: 200 psig minimum, unless otherwise indicated.
- 3. SWP: 125 psig minimum, unless otherwise indicated.
- 4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
- 5. End Connections: Threaded or soldered for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
- 6. Screen: Stainless steel with round perforations, unless otherwise indicated.
- 7. Perforation Size:
  - a. Strainers NPS 2 and Smaller: 0.033 inch.
  - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
  - c. Strainers NPS 5 and Larger: 0.045 inch.
- 8. Drain: Pipe plug.

## 2.5 OUTLET BOXES

### A. Icemaker Outlet Boxes, OB-1:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Sioux Chief Manufacturing Company, Inc.; Ox Box.
  - b. Oatey SCS.



- c. LSP Products Group, Inc.
  - d. Acorn Engineering Company.
2. Mounting: Recessed.
  3. Material and Finish: Enameled- or epoxy-painted-steel or Stainless-steel box and faceplate.
  4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
  5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

## 2.6 HOSE BIBBS

### A. Hose Bibbs, HB-1:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Chrome or nickel plated.
9. Finish for Service Areas: Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Operating key.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

## 2.7 WALL HYDRANTS

### A. Nonfreeze Wall Hydrants, WH-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Water Technologies, Inc.; Watts Regulator co.
  - f. Woodford Manufacturing Company.
  - g. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.21.3M for self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.

8. Box: Deep, flush mounting with cover.
9. Box and Cover Finish: Polished nickel bronze or chrome plated.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Operating Keys(s): One with each wall hydrant.

## 2.8 WATER HAMMER ARRESTERS

### A. Water Hammer Arresters (Copper Tube Type):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. MIFAB, Inc.
  - b. PPP Inc.
  - c. Sioux Chief Manufacturing Company, Inc.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Drainage Products Inc.
  - f. Watts Water Technologies, Inc.; Watts Regulator Co.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

### B. Water Hammer Arresters (Metal Bellows Type):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. AMTROL, Inc.
  - b. Josam Company.
  - c. MIFAB, Inc.
  - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - e. Tyler Pipe; Wade Div.
  - f. Watts Drainage Products Inc.
  - g. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Precharged stainless steel bellows.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

## 2.9 AIR VENTS

### A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

- B. Welded-Construction Automatic Air Vents:
  - 1. Body: Stainless steel.
  - 2. Pressure Rating: 150-psig minimum pressure rating.
  - 3. Float: Replaceable, corrosion-resistant metal.
  - 4. Mechanism and Seat: Stainless steel.
  - 5. Size: NPS 3/8 minimum inlet.
  - 6. Inlet and Vent Outlet End Connections: Threaded.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
  - 1. Locate backflow preventers in same room as connected equipment or system.
  - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
  - 3. Do not install bypass piping around backflow preventers.
  - 4. Install strainer and soft-seated check valve upstream of backflow preventer. Exception: Fire protection backflow preventers.
- C. Install balancing valves in locations where they can easily be adjusted.
- D. Install temperature-actuated water mixing valves with strainers, and check stops or shutoff valves on inlets and with shutoff valve on outlet.
  - 1. Install thermometers and water regulators if specified.
  - 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- E. Install water hammer arresters in water piping according to PDI-WH 201.
- F. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

#### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20 and 22 Sections. Drawings indicate general arrangement of piping and specialties.

### 3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  - 1. Reduced-pressure-principle backflow preventers.
  - 2. Calibrated balancing valves.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 20 Section "Mechanical Identification."

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
  - 1. Test each backflow prevention device according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

### 3.5 ADJUSTING

- A. Set field-adjustable flow set points of balancing valves as follows:
  - 1. Set calibrated balancing valves at calculated presettings.
  - 2. Measure flow each station and adjust where necessary.
  - 3. Record settings and mark balancing devices.
- B. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements".
  - 2. Division 20 Section "Basic Mechanical Materials and Methods".
  - 3. Division 22 Section "Drainage Piping Specialties".
  - 4. Division 22 Section "Chemical-Waste Piping" for chemical-waste and vent piping systems.
  - 5. Division 22 Section "Sewage Pumps."
  - 6. Division 22 Section "Sanitary Sewage" for piping outside building.

1.2 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. LLDPE: Linear, low-density polyethylene plastic.
- D. NBR: Acrylonitrile-butadiene rubber.

- E. PE: Polyethylene plastic.
- F. PVC: Polyvinyl chloride plastic.
- G. TPE: Thermoplastic elastomer.

### 1.3 SYSTEMS DESCRIPTIONS

- A. Sanitary waste and vent piping system materials are scheduled on the Drawing.

### 1.4 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field quality-control inspection and test reports.

### 1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Cast-iron soil pipe shall be marked with the collective trademark of Cast Iron Soil Pipe Institute (CISPI).
- C. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

### 1.6 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sanitary waste service.
  - 2. Do not proceed with interruption of sanitary waste service without Construction Manager's written permission.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
  1. Manufacturers:
    - a. ANACO-Husky; McWane Plumbing Group.
    - b. Ferguson Enterprises, Inc.; ProFlo (Private labeled IDEAL-TRIDON).
    - c. IDEAL-TRIDON.
    - d. Mission Rubber Company; a division of MCP Industries, Inc.
    - e. Tyler Pipe; McWane Plumbing Group.
  2. Standards: CISPI 310.
  3. Description: NSF certified for compliance with CISPI 310. Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Hubless-Piping Couplings:
  1. Manufacturers:
    - a. ANACO-Husky; McWane Plumbing Group; SD 4000.
    - b. Ferguson Enterprises, Inc.; ProFlo (Private labeled IDEAL-TRIDON).
    - c. IDEAL-TRIDON; Heavy-Duty "HD" No-Hub Couplings.
    - d. Norma Group; Clamp-All Products; HI-TORQ 125.
  2. Standards: ASTM C 1277 and ASTM C 1540, or ASTM C 1277 and FM 1680 Class I.
  3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

## 2.3 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: Schedule 40, ASTM D 2665, drain, waste, and vent.
  1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

## PART 3 - EXECUTION

### 3.1 EXCAVATION

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

### 3.2 PIPING SYSTEM INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Sanitary sewer piping outside the building is specified in Division 22 Section "Sanitary Sewerage."
- C. Basic piping installation requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- D. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- E. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.
- F. Install underground, ductile-iron, special pipe fittings according to AWWA C600.
  - 1. Install encasement on piping according to ASTM A 674 or AWWA C105.
- G. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back-to-back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- J. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
  - 1. Building Sanitary Drain: 1/8-inch per foot downward in direction of flow, unless otherwise noted.
  - 2. Horizontal Sanitary Drainage Piping: 1/8-inch per foot downward in direction of flow, unless otherwise noted.
  - 3. Vent Piping: 1/8-inch per foot down toward vertical fixture vent or toward vent stack.
- K. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- L. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.



- M. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

### 3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- B. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

### 3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
  - 1. Install transition couplings at joints of piping with small differences in OD's.
  - 2. In Drainage Piping: Unshielded, nonpressure transition couplings.

### 3.5 VALVE INSTALLATION

- A. General valve installation requirements are specified in Division 20 Section "Valves."
- B. Backwater Valves: Install backwater valves in piping subject to sewage backflow.
  - 1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
  - 2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
  - 3. Install backwater valves in accessible locations.
  - 4. Backwater valves are specified in Division 22 Section "Drainage Piping Specialties."

### 3.6 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 20 Section "Hangers and Supports." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Install individual, straight, horizontal piping runs according to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.

- B. Install supports according to Division 20 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  - 4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
  - 5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
  - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.

### 3.8 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 20 Section "Mechanical Identification."

### 3.9 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
  - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
  - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 6. Prepare reports for tests and required corrective action.

### 3.10 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."

1.2 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories.

1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

- B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary and storm piping specialty components.

## 1.5 COORDINATION

- A. Coordinate size and location of roof penetrations.

## PART 2 - PRODUCTS

### 2.1 CAST-IRON CLEANOUTS

- A. Size: Cleanouts shall be same nominal size as the pipe they serve up to 4 inches. For pipes larger than 4 inches nominal size, minimum size of cleanout shall be 4 inches.

- B. Exposed Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company; Josam Div.; Series 58910.
  - b. MIFAB, Inc.; C1460.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; 4510 Series.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Drainage Products Inc.
  - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk or raised-head, brass or bronze plug with tapered threads.

- C. Cast-Iron Floor Cleanouts (On-Grade Interior Floor Areas):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company; Josam Div.
  - b. MIFAB, Inc.; C1220-R.
  - c. Sioux Chief Manufacturing Company, Inc.
  - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; Model 4023S-F.
  - e. Tyler Pipe; Wade Div.
  - f. Watts Drainage Products Inc.
  - g. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M.
3. Type: Adjustable housing.
4. Body or Ferrule: Cast iron.
5. Clamping Device: Not required.
6. Outlet Connection: Spigot.
7. Closure: Brass, bronze, or plastic plug with tapered threads.
8. Adjustable Housing Material: Cast iron with threads, set-screws or other device.

9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy with scoriated cover in service areas, and recessed cover to accept floor finish material in finished floor areas.
10. Frame and Cover Shape: Round.
11. Top Loading Classification: Medium Duty.
12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

D. Cast-Iron Floor Cleanouts (Not-On-Grade Interior Floor Areas):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company; Josam Div.
  - b. MIFAB, Inc.; C-1100-C-R-34.
  - c. Sioux Chief Manufacturing Company, Inc.
  - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; Model 4333C.
  - e. Tyler Pipe; Wade Div.
  - f. Watts Drainage Products Inc.
  - g. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M.
3. Type: Adjustable housing.
4. Body or Ferrule: Cast iron.
5. Clamping Device: Required.
6. Outlet Connection: Spigot.
7. Closure: Brass, bronze, or plastic plug with tapered threads.
8. Adjustable Housing Material: Cast iron with threads, set-screws or other device.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy with scoriated cover in service areas, and recessed cover to accept floor finish material in finished floor areas.
10. Frame and Cover Shape: Round.
11. Top Loading Classification: Medium Duty.
12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

E. Cast-Iron Wall Cleanouts (Finished Wall Areas):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company; Josam Div.; Model 58790-20.
  - b. MIFAB, Inc.; C1460-RD.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Drainage Products Inc.
  - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M. Include wall access.
3. Body: Hub-and-spigot, cast-iron soil pipe T-branch or hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk or raised-head, drilled-and-threaded bronze or brass plug with tapered threads.
5. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

## 2.2 FLOOR DRAINS

### A. Cast-Iron Floor Drains, FD-1:Kitchen General Area Drains

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company; Josam Div.
  - b. MIFAB, Inc.
  - c. Sioux Chief Manufacturing Company, Inc.; Finish Line Adjustable Drainage System.
  - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; Model 2005Y-A.
  - e. Tyler Pipe; Wade Div.
  - f. Watts Drainage Products Inc.
  - g. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Clamping Device: Required.
7. Outlet: Bottom.
8. Coating on Interior and Exposed Exterior Surfaces: Enamel.
9. Top or Strainer Material: Nickel bronze.
10. Top of Body and Strainer Finish: Nickel bronze.
11. Top Shape: Round, with vandal proof screws.
12. Dimensions of Top or Strainer: 7 inch diameter.
13. Top Loading Classification: Light Duty.
14. Inlet Fitting: Gray iron, with spigot outlet.
15. Trap-Seal Protection: Barrier type trap seal protection device.

### B. Cast-Iron Floor Drains, FD-2: Mechanical Room Drains

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company; Josam Div.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; Model 2142.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Drainage Products Inc.
  - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Clamping Device: Required.
7. Outlet: Bottom.
8. Coating on Interior and Exposed Exterior Surfaces: Enamel.
9. Sediment Bucket: 3-3/4 inches deep, slotted sediment bucket with lift bar.
10. Top or Strainer Material: Cast-iron.
11. Top Shape: Round.
12. Dimensions of Top or Strainer: 11-1/2 inch diameter tractor grate, 29 square inches of free area. Provide partial grate where required to accept equipment drains.
13. Top Loading Classification: Heavy Duty.

14. Outlet Fitting: Gray iron, with spigot outlet.
15. Trap-Seal Protection: Barrier type trap seal protection device.

## 2.3 FLOOR SINKS

### A. Stainless-Steel Floor Sink Drains FS-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company; Josam Div.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; Model 3006-12.
  - d. Tyler Pipe; Wade Div.
  - e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.7.
3. Outlet: Bottom unless otherwise noted.
4. Top or Strainer Material: Stainless steel.
5. Top Shape: Square.
6. Dimensions of Top or Strainer: 12 inch by 12 inch, 14 gage, Type 304 stainless steel ribbed, non-tilt loose set half grate with 1/2 inch square holes and perforated stainless steel sediment bucket.
7. Seepage Flange: Required.
8. Clamping Device: Required.
9. Trap-Seal Protection: Barrier type trap seal protection device.

## 2.4 TRAP SEAL PROTECTION DEVICES

### A. Barrier Type Trap Seal Protection Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Smith, Jay R. Mfg. Co.; Quad Close Trap Seal Device Fig. 2692.
  - b. Rectorseal; a CSW Industrials Company; SureSeal Plus Inline Floor Drain Trap Sealer.
2. Standard: ASSE 1072-2007.
3. Sealing Element: Neoprene rubber or chemically resistant elastomer.
4. Size: 2 inch, 3 inch, 3-1/2 inch, or 4 inch.
5. Gravity Drain Outlet Connection: Compression fit sealing gasket 80 durometer.

## 2.5 ROOF DRAINS

### A. Metal Roof Drains RD-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company; Josam Div.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; Model 1015.



- d. Tyler Pipe; Wade Div.
  - e. Watts Drainage Products Inc.
  - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.4
  3. Pattern: Roof drain.
  4. Body Material: Cast iron.
  5. Dimensions of Body: Minimum 10 inch diameter body.
  6. Combination Flashing Ring and Gravel Stop: Required.
  7. Flow-Control Weirs: Not required.
  8. Outlet: Bottom unless otherwise noted.
  9. Dome Material: Cast iron, or ductile iron.
  10. Extension Collars: Required.
  11. Underdeck Clamp: Required.
  12. Sump Receiver: Required.
- B. Metal Secondary Roof Drains ORD-1:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.
    - b. MIFAB, Inc.
    - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; Model 1074.
    - d. Tyler Pipe; Wade Div.
    - e. Watts Drainage Products Inc.
    - f. Zurn Plumbing Products Group; Specification Drainage Operation.
  2. Standard: ASME A112.6.4
  3. Pattern: Roof drain.
  4. Body Material: Cast iron.
  5. Dimensions of Body: Minimum 10 inch diameter body.
  6. Combination Flashing Ring and Gravel Stop: Required.
  7. Flow-Control Weirs: Not required.
  8. Outlet: Bottom unless otherwise noted.
  9. Dome Material: Cast iron, or ductile iron.
  10. Extension Collars: Required.
  11. Underdeck Clamp: Required.
  12. Sump Receiver: Required.
  13. Standpipe: Cast iron. 2 inches high where overflow drains are indicated.

## 2.6 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES

- A. Air-Gap Fittings:
1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
  2. Body: Bronze or cast iron.
  3. Inlet: Opening in top of body.
  4. Outlet: Larger than inlet.
  5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.
- B. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

C. Downspout Covers DNZ-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; Fig. No. 1775.
  - b. Zurn Plumbing Products Group; Specification Drainage Operation; Z199-DC.
2. Description: Round fabricated stainless steel frame with mounting holes, and with fabricated secured perforated stainless steel hinged strainer.
3. Size: Same as connected conductor.

## 2.7 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
  1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
  2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
  3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:
  1. General Applications: 12 oz./sq. ft.
  2. Vent Pipe Flashing: 8 oz./sq. ft.
- C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- E. Fasteners: Metal compatible with material and substrate being fastened.
- F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- G. Solder: ASTM B 32, lead-free alloy.
- H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

## 2.8 GREASE INTERCEPTORS

- A. Grease Interceptors, GI-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company; Josam Div.
  - b. Lowe Engineering; a div. of Highland Tank & Manufacturing Co., Inc.
  - c. MIFAB, Inc.
  - d. Schier Products Company, GB-250.
  - e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - f. Tyler Pipe; Wade Div.
  - g. Watts Drainage Products Inc.
  - h. Zurn Plumbing Products Group.
2. Standard: ASME A112.14.3, for intercepting and retaining fats, oils, and greases from food-preparation or -processing wastewater.
3. Plumbing and Drainage Institute Seal: Not required.
4. Body Material: Cast iron, steel, or polypropylene.
5. Interior Lining: Corrosion-resistant enamel for cast iron or steel bodies. Not required for polypropylene bodies.
6. Exterior Coating: Corrosion-resistant enamel for cast iron or steel bodies. Not required for polypropylene bodies.
7. Body Extension: Required.
8. Size and Capacities: 4" inlet & 4" outlet. 87" L x 33" W x 44" H. 1,895 lbs. of grease @ 100 GPM
9. Cleanout: Integral or field installed on outlet.
10. Mounting: Recessed, flush with floor.
11. Flow-Control Fitting: Required.
12. Operation: Manual cleaning.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  2. Locate at each change in direction of piping greater than 45 degrees.
  3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  - 1. Position floor drains for easy access and maintenance.
  - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
  - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- G. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 07.
  - 1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
  - 2. Position roof drains for easy access and maintenance.
- H. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- I. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.
- J. Install wood-blocking reinforcement for wall-mounting-type specialties.
- K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- L. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20 and 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

### 3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
  - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
  - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
  - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
  - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
  - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- F. Fabricate and install flashing and pans, sumps, and other drainage shapes.

### 3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 22 Section "Drainage Piping Specialties."

1.2 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. LLDPE: Linear, low-density polyethylene plastic.
- C. PE: Polyethylene plastic.
- D. PVC: Polyvinyl chloride plastic.
- E. TPE: Thermoplastic elastomer.

1.3 SYSTEMS DESCRIPTIONS

- A. Storm drainage piping system materials are scheduled on the Drawing.

#### 1.4 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field quality-control inspection and test reports.

#### 1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Cast-iron soil pipe shall be marked with the collective trademark of Cast Iron Soil Pipe Institute (CISPI).
- C. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

#### 2.2 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
  - 1. Manufacturers: Plumbing
    - a. ANACO-Husky; McWane Group.
    - b. Ferguson Enterprises, Inc.; ProFlo (Private labeled IDEAL-TRIDON).
    - c. IDEAL-TRIDON.
    - d. Mission Rubber Company; a division of MCP Industries, Inc.
    - e. Tyler Pipe; McWane Plumbing Group.
  - 2. Standards: CISPI 310.
  - 3. Description: NSF certified for compliance with CISPI 310. Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

### 2.3 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: Schedule 40, ASTM D 2665, drain, waste, and vent.
  - 1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

## PART 3 - EXECUTION

### 3.1 EXCAVATION

- A. Refer to Division 31 Section "Earthwork" for excavating, trenching, and backfilling.

### 3.2 PIPING SYSTEM INSTALLATION

- A. Storm sewer and drainage piping outside the building are specified in Division 33 Section "Storm Drainage."
- B. Basic piping installation requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- C. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section "Drainage Piping Specialties."
- D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- E. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- F. Make changes in direction for storm piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- G. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- H. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
  - 1. Building Storm Drain: 1/8-inch per foot downward in direction of flow, unless otherwise noted.
  - 2. Horizontal Storm-Drainage Piping: 1/8-inch per foot downward in direction of flow, unless otherwise noted.



- I. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- J. Install underground PVC storm drainage piping according to ASTM D 2321.
- K. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

### 3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- B. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 20 Section "Hangers and Supports." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 20 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  - 4. NPS 6: 60 inches with 3/4-inch rod.
  - 5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
  - 6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.

### 3.6 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
  - 4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 5. Prepare reports for tests and required corrective action.

3.7 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221413

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 10 Section "Toilet and Bath Accessories."
  - 2. Division 20 Section "Mechanical General Requirements."
  - 3. Division 20 Section "Basic Mechanical Materials and Methods."
  - 4. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers; individual-fixture, water tempering valves; and specialty fixtures not included in this Section.
  - 5. Division 22 Section "Drainage Piping Specialties" for floor drains, and specialty fixtures not included in this Section.

1.2 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.

- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
- D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
- E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- F. FRP: Fiberglass-reinforced plastic.
- G. PMMA: Polymethyl methacrylate (acrylic) plastic.
- H. PVC: Polyvinyl chloride plastic.
- I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

### 1.4 INFORMATIONAL SUBMITTALS

- A. Shop Drawings: Diagram power, signal, and control wiring.
- B. Coordination Drawings: Counter cutout templates for mounting of counter-mounted plumbing fixtures.

### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For plumbing fixtures and trim to include in operation and maintenance manuals.

### 1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
  - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- F. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," and NSF 372 Drinking Water System Components - Lead Content for potable domestic water piping and components.
- G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- H. Comply with applicable ANSI, ASME, ASSE, ASTM, ICC, NSF, and UL standards and other requirements specified for plumbing fixtures, trim, fittings, components, and features.

## PART 2 - PRODUCTS

### 2.1 WATER CLOSETS

#### A. Water Closets, WC-1:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard Companies, Inc.; MADERA Floor Mounted Elongated Toilet.
  - b. Ferguson Enterprises, Inc.; ProFlo.
  - c. Kohler Co.; Kingston K-PR96057-T4DS.
  - d. Sloan Valve Company.
  - e. Zurn Plumbing Products Group; EcoVantage.
- 2. Description: Wall-mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.
  - a. Style: Flushometer valve.
    - 1) Bowl Type: Elongated with siphon-jet design.
    - 2) Supply Spud Location: Top.
    - 3) Design Consumption: 1.28 gal./flush.
    - 4) Color: White.
  - b. Flushometer: FV-2-2.
  - c. Toilet Seat: TS-1.
  - d. Fixture Support: Water-closet support combination carrier.

## 2.2 BATTERY OPERATED SENSOR WATER CLOSET FLUSHOMETERS

### A. Flushometers, FV-2-2:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard Companies, Inc.
  - b. Delany Products.
  - c. Delta Faucet Company.
  - d. Kohler Co. Wave.
  - e. Moen Commercial.
  - f. Sloan Valve Company.
  - g. Speakman Company.
  - h. Zurn Plumbing Products Group.
2. Description: Flushometer for water-closet-type fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, courtesy flush feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
  - a. Internal Design: Diaphragm or piston operation.
  - b. Style: Exposed.
  - c. Inlet Size: NPS 1.
  - d. Trip Mechanism: Battery-operated sensor actuator.
  - e. Consumption: 1.28 gal./flush.
  - f. Tailpiece Size: NPS 1-1/2 and standard length to top of bowl.

## 2.3 TOILET SEATS

### A. Toilet Seats, TS-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Bemis Manufacturing Company; 1955SSC/1955SSCT.
  - b. Centoco Manufacturing Corp.
  - c. Church Seats; 295SSC/295SSCT.
  - d. Comfort Seats; a Jones Stephens Brand; Model Number C106SSC.
  - e. Ferguson Enterprises, Inc.; ProFlo PFTSCOF2000WH.
  - f. Olsonite Seat Company; Model 10SSC/10SSCT.
  - g. Plumbtech; Plumbing Technologies, LLC.
  - h. Sanderson Plumbing Products, Inc.; Beneke Div.
  - i. Zurn Plumbing Products Group; 5955STS-WH.
2. Description: Toilet seat for water-closet-type fixture.
  - a. Material: Molded, solid plastic.
  - b. Configuration: Open front without cover.
  - c. Size: Elongated.
  - d. Hinge Type: SC, self-sustaining, check.
  - e. Class: Standard commercial.
  - f. Color: White.

## 2.4 LAVATORIES

### A. Lavatories, LAV-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard Companies, Inc.; Lucerne Model 0355.012.
  - b. Ferguson Enterprises, Inc.; ProFlo PF5504.
  - c. Kohler Co.; K 2005 Kingston.
  - d. Sloan Valve Company.
  - e. Zurn Plumbing Products Group; Z5344.
2. Description: Accessible, wall-mounting, vitreous-china fixture.
  - a. Type: With contoured back and side shields.
  - b. Size: 20 by 18 inches rectangular.
  - c. Faucet Hole Punching: Three holes, 2-inch centers.
  - d. Color: White.
  - e. Faucet: LF-1.
  - f. Water Temperature Limiting Device: Required.
  - g. Drain: Grid with offset waste.
  - h. Drain Piping: NPS 1-1/4 chrome-plated, cast-brass P-trap; NPS 1-1/4, 17 gage tubular brass waste to wall; and wall escutcheon.
  - i. Fixture Support: Lavatory with concealed arms.

## 2.5 LAVATORY FAUCETS

### A. Lavatory Faucets, LF-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard Companies, Inc.; Innsbrook Model 6055.205.
  - b. Chicago Faucets; Model 115.737.21.1.
  - c. Delta Faucet Company; Model 591-LGHGMHDF.
  - d. Geberit Manufacturing, Inc.
  - e. Kohler Co.; K13461 (with K13478-A escutcheon).
  - f. Moen Commercial.
  - g. Sloan Valve Company.
  - h. Speakman Company.
  - i. Zurn Plumbing Products Group; Z6917.
2. Description: Single hole faucet with escutcheon suitable for 4 inch centers, grid strainer, and no lift rod hole.
  - a. Body Material: Commercial, solid brass.
  - b. Finish: Polished chrome plate.
  - c. Mounting: Deck, concealed.
  - d. Inlet(s): NPS 1/2.
  - e. Spout Outlet: Vandal resistant spray, 0.5 gpm.
  - f. Operation: Sensor/Battery.



## 2.6 COUNTER MOUNTING SINKS

### A. Sinks, SK-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Elkay Manufacturing Co.
  - b. Franke Consumer Products, Inc., Commercial Div.
  - c. Just Manufacturing Company.
  - d. Moen Commercial.
2. Description: Single-bowl, deep basin, counter-mounting, lay-in stainless-steel sink.
  - a. Overall Dimensions: 19 inches left to right by 23 inches front to back.
  - b. Metal Thickness: 18 gage, with sound dampened underside.
  - c. Bowl:
    - 1) Dimensions: 16 inches by 13 inches by 9 inches deep.
    - 2) Drain: 3-1/2-inch grid.
  - d. Sink Faucet: SF-1.
  - e. Water Temperature Limiting Device: Not required.
  - f. Drain Piping: NPS 1-1/2 chrome-plated, cast-brass P-trap; 17 gage tubular brass waste to wall; and wall escutcheon(s).
  - g. Disposer: D-1.
  - h. Dishwasher Air-Gap Fitting: Not required.
  - i. Hot-Water Dispenser: Not required.

## 2.7 SINK FAUCETS

### A. Sink Faucets, SF-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard Companies, Inc.
  - b. Chicago Faucets; No. 786-GN8AFCABCP.
  - c. Kohler Co.
  - d. Moen Commercial.
  - e. Speakman Company.
  - f. T & S Brass and Bronze Works, Inc.
  - g. Zurn Plumbing Products Group; Z831C4-140.
2. Description: Sink faucet. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
  - a. Body Material: Commercial, solid brass.
  - b. Finish: Polished chrome plate.
  - c. Mixing Valve: Two handle.
  - d. Centers: 8 inches.
  - e. Mounting: Deck.
  - f. Handle(s): Wrist blade, 4 inches.
  - g. Operation: Noncompression, manual.

- h. Inlet(s): NPS 1/2.
- i. Spout Type: 70-degree restricted swing gooseneck.
- j. Spout Outlet: Aerator.
  - 1) Aerator.
  - 2) Laminar flow or plain end for patient care areas.
- k. Maximum Flow Rate:
  - 1) 1.5 gpm.

## 2.8 DISPOSERS

### A. Disposers, D-1:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. In-Sink-Erator; a div. of Emerson Electric Co.
- 2. Description: Continuous-feed, food-waste disposer. Include reset button; wall switch; corrosion-resistant chamber with jam-resistant, cutlery- or stainless-steel grinder or shredder; NPS 1-1/2 outlet; quick-mounting, stainless-steel sink flange; antisplash guard; and combination cover/stopper.
  - a. Motor: 115-V ac, 1725 rpm, 1-1/4 hp with overload protection.

## 2.9 FIXTURE SUPPLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. BrassCraft; a Masco Company.
  - 2. McGuire Mfg. Co., Inc.
  - 3. Any of the approved plumbing fixture manufacturers.
- B. Description: Chrome-plated brass, loose-key or screwdriver angle stops with brass stems; rigid, chrome-plated copper risers; and chrome-plated wall flanges.

## 2.10 PROTECTIVE SHIELDING GUARDS

### A. Protective Shielding Pipe Covers (PSG-1):

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Engineered Brass Co.
  - b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
  - c. McGuire Manufacturing Co., Inc.
  - d. Plumberex Specialty Products Inc.
  - e. TCI Products; SG-200BV.
  - f. TRUEBRO, Inc.
  - g. Zurn Plumbing Products Group; Z8946-3-NT.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

## 2.11 FIXTURE SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Josam Company.
  2. MIFAB Manufacturing Inc.
  3. Smith, Jay R. Mfg. Co.
  4. Tyler Pipe; Wade Div.
  5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
  6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Lavatory Supports:
  1. Description: Lavatory carrier with concealed arms and tie rods for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
  2. Accessible-Fixture Support: Include rectangular steel uprights.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
  1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
  2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
  3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install counter-mounting fixtures in and attached to casework.
- G. Install fixtures level and plumb according to roughing-in drawings. Install accessible fixtures at heights required by local codes.
- H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
  - 1. Exception: Fixtures with flushometer valves, and faucets or valves with integral stops.
- I. Install ASSE 1070 water-temperature limiting devices on supplies for lavatories and sinks that will be used for handwashing, and where specified. Refer to Division 20 Section "Domestic Water Piping Specialties."
- J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- L. Install protective shielding guards PSG-1 on exposed traps and supplies of lavatories, and sinks used for hand washing.
- M. Install toilet seats on water closets.
- N. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- O. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- P. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- Q. Install traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
  - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- R. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- S. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20 and 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Individual water line branches, waste lines, vents, and traps for connection to individual fixtures, fixture fittings and specialties shall be in accordance with the schedule on the Drawings.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding."
- E. Connect wiring according to Division 26 Section "Conductors and Cables."

### 3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

### 3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- C. Adjust flow at laboratory faucets having serrated nozzles to prevent splashing.
- D. Replace washers and seals, or cartridges of leaking and dripping faucets and stops.
- E. Install fresh batteries in sensor-operated mechanisms.

### 3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
  - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
  - 2. Remove sediment and debris from drains.

- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

### 3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224200

SECTION 224500 - EMERGENCY PLUMBING FIXTURES

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers and water filters.
  - 4. Division 22 Section "Drainage Piping Specialties" for floor drains and cleanouts.
  - 5. Division 22 Section "Plumbing Fixtures" for laboratory faucets with integral eyewash.

1.2 DEFINITIONS

- A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.
- C. Tepid: Moderately warm.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Shop Drawings: Diagram power, signal, and control wiring.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Field quality-control test reports.
- B. Operation and Maintenance Data: For emergency plumbing fixtures to include in maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- B. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."
- C. ASSE Standard: Comply with ASSE 1071 "Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment" for emergency mixing valves.
- D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- E. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" for plumbing fixtures for people with disabilities.

### PART 2 - PRODUCTS

#### 2.1 EYE/FACE WASH EQUIPMENT

- A. Eye/Face Wash Equipment, EE-1:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bradley Corporation; Halo S19214 Series.
    - b. Guardian Equipment Co.
    - c. Haws Corporation.
    - d. Speakman Company; Optimus SE-1150.
    - e. Stingray Systems.
  - 2. Description: Plumbed, freestanding, pedestal eye/face wash equipment.
    - a. Capacity: Deliver potable water at rate not less than 3.0 gpm for at least 15 minutes.
    - b. Supply Piping: NPS 1/2 chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
    - c. Control-Valve Actuator: Paddle, push bar, or treadle.



- d. Receptor: Stainless-steel bowl.
- e. Drain Piping: NPS 1-1/4 minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2. Include galvanized-steel indirect connection to drainage system.

## 2.2 WATER-TEMPERING EQUIPMENT

### A. Water-Tempering Equipment, MV-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Acorn Controls; Morris Group International; ET71 Series.
  - b. Armstrong International, Inc. (RADA)
  - c. Bradley Corporation.
  - d. Guardian Equipment Co.
  - e. Haws Corporation.
  - f. Lawler Manufacturing Co., Inc.; Model 911 E/F.
  - g. Leonard Valve Company.
  - h. Powers, a Watts Industries Co.; Model ES 150.
  - i. Speakman Company.
  - j. Stingray Systems; SV107.
2. Description: Factory-fabricated, hot- and cold-water-tempering equipment with thermostatic mixing valve.
  - a. Thermostatic Mixing Valve: Designed to provide 85 deg F tepid, potable water at a single emergency eyewash or eye/face wash fixture, to maintain temperature at plus or minus 5 deg F throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.

## 2.3 SOURCE QUALITY CONTROL

- ### A. Certify performance of emergency plumbing fixtures by independent testing agency acceptable to authorities having jurisdiction.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- #### A. Examine roughing-in for piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 EMERGENCY PLUMBING FIXTURE INSTALLATION

- #### A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

- B. Install fixtures level and plumb.
- C. Fasten fixtures to substrate.
- D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Valves are specified in Division 22 Section "General Duty Valves for Plumbing."
  - 1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency plumbing fixture.
  - 2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.
- E. Install dielectric fitting in supply piping to fixture if piping and fixture connections are made of different metals. Dielectric fittings are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- F. Install thermometers in supply and outlet piping connections to water-tempering equipment. Thermometers are specified in Division 20 Section "Meters and Gages."
- G. Install trap and waste to wall on drain outlet of fixture receptors that are indicated to be directly connected to drainage system.
- H. Install indirect waste piping to wall on drain outlet of fixture receptors that are indicated to be indirectly connected to drainage system. Drainage piping is specified in Division 22 Section "Sanitary Waste and Vent Piping."
- I. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Escutcheons are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- J. Install equipment nameplates or equipment markers on fixtures and equipment signs on water-tempering equipment. Identification materials are specified in Division 20 Section "Mechanical Identification."

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20 and 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect hot- and cold-water-supply piping to hot- and cold-water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures.
- C. Connect cold water and electrical power to electric heating water-tempering equipment.
- D. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary or storm drainage piping.

### 3.4 FIELD QUALITY CONTROL

- A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities and temperatures.
- B. Electrical-Component Testing: After electrical circuitry has been energized, test for compliance with requirements.
  - 1. Test and adjust controls and safeties.
- C. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.
- D. Report test results in writing.

### 3.5 ADJUSTING

- A. Adjust or replace fixture flow regulators for proper flow.
- B. Adjust equipment temperature settings.

END OF SECTION 224500

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 23 Section "Testing, Adjusting, and Balancing."

1.2 SUMMARY

- A. This Section includes common requirements for fans and air moving equipment.

1.3 SUBMITTALS

- A. Product Data: For the following:
  - 1. Fan bearings.
  - 2. V-belt fan drives.

3. Direct drive couplings.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- B. Fan Performance Data: AMCA Standard 210.
- C. Sound Power Level Ratings:
  1. Ducted Fans - Rated per AMCA 301, when tested per AMCA 300.
  2. Nonducted Fans - Rated in Zones at 5 feet from acoustic center of fan rated per AMCA 301, tested per AMCA 300 and converted per AMCA 302.

#### 1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate equipment for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

#### 2.2 FAN SHAFTS

- A. Fan Shafts: Ground from solid cold rolled steel, and proportioned to run at least 25 percent below the first critical speed.

#### 2.3 FAN POWER TRANSMISSION

- A. V-Belt Type Fan Drives: In accordance with Engineering Standard Specification for Drives Using Multiple V-Belts, sponsored by the Mechanical Power Transmission Association and the Rubber Manufacturer's Association.
- B. A given manufacturer's V-belt drive, as applied to specific equipment provided under the Contract, shall conform to the equipment manufacturer's published recommendations, except as otherwise specified.
- C. Base horsepower rating of drive on minimum pitch diameter of small sheave.

- D. Locate belt drives outboard of bearings. Align drive and driven shafts by the four-point method.
- E. Adjust belt tension in accordance with the manufacturer's recommendations.
- F. Perform alignment and final belt tensioning in the presence of the Architect.

#### 2.4 SHEAVES

- A. Furnish sheaves of machined cast iron or carbon steel, bushing type of fixed bore, secured to the shaft by key and keyway.
- B. For all constant speed fans at or above 2 inches of total static pressure, Contractor shall provide and install two sets of fixed sheaves. First set shall be installed for initial start-up and shall be based on scheduled data. The second set shall be installed after system balance is complete and shall be based on actual field conditions.
- C. For all constant speed fans below 2 inches total static pressure, Contractor shall provide and install two sets of adjustable sheaves. First set shall be installed for initial start-up and shall be based on scheduled data. The second set shall be installed after the balance is complete and shall be based on actual field conditions, and selected at mid-range of the sheave.
- D. Set pitch diameters of fixed pitch and adjustable or variable pitch sheaves when adjusted as specified, at not less than that recommended by NEMA Standard MG1-14.42.
- E. For companion sheaves for adjustable or variable pitch drives, furnish wide groove spacing to match driving sheaves.
- F. For all variable frequency controller (VFC) operated fans, contractor shall provide and install one set of fixed sheaves sized to allow full utilization of fan motor horsepower provided, with VFC at 100 percent of fan motor RPM.

#### 2.5 V-BELT FAN DRIVES

- A. Fan Drives: Multiple V-belt style with adjustable pitch driver sheaves for fans up to 2 inches of total static pressure and fixed pitch driver sheaves for fans at or above 2 inches of total static pressure and up. Sheaves shall have split, taper style bushings. Drives shall be selected for a 150 percent service factor and shall provide for adjustment of both belt tension and alignment.
- B. Manufacturers:
  - 1. Emerson Power Transmission; Browning.
  - 2. Rockwell Automation; Dodge.
  - 3. T.B. Wood's Incorporated.

#### 2.6 FAN DRIVE, SHAFT, AND COUPLING GUARDS

- A. Safety Provisions: Include guards and screens for power transmission equipment, but do not negate vibration isolation provision.

- B. Furnish ANSI and OSHA compliant mechanical power transmission apparatus guards except where superseded by other governing codes, and except as modified and supplemented. Requirements specified apply to all types of fans.
- C. Fabricate mechanical power transmission device guards such that the completed structure is capable of withstanding a load of at least 200 pounds applied in any direction.
- D. Furnish a guard enclosure for each V-belt drive, coupling, shaft, and rotating component. Secure guards in place, easily removable for maintenance. Guard fasteners used for maintenance access shall be "captive type." Locate holes on each guard for tachometer readings on both the motor and fan shafts. Fabricate guard of minimum 16 gage sheet metal with hemmed edges at openings for shafts. Weld four mounting lugs or feet of 10 gage material to the guard. Fabricate guards for couplings five inches in diameter and larger of 12 gage sheet metal. Furnish holes in mounting feet sized for suitable machine screws.
- E. Centrifugal exhaust fans shall be provided with shaft seals.

## 2.7 BELT DRIVE GUARDS

- A. Belt Guards: ANSI and OSHA compliant with provision for readily viewing belt tension and measuring shaft speeds. Guards shall be installed with quick release pins, so that removal of three to five clip pins, will allow the guard to be removed from fan housing.
- B. Fabricate guards which completely enclose moving parts of the particular drive. Design and construct guards of such rigidity as to contain a belt which breaks during operation. Minimum material thickness, 16 gage sheet metal. Where ventilation is required, perforated metal shall be used for the sides. Fabricate top of solid sheet metal.

## 2.8 V-BELTS

- A. Notched or cogged style, endless type, of Dacron reinforced elastomer construction, with cross-section to suit sheave grooves. Determine the number of V-belts from the motor horsepower to which apply the service factor to obtain the design horsepower. Determine the corrected horsepower per belt by multiplying the nominal horsepower per belt by an arc of contact factor not greater than 0.85. Divide the design horsepower by the corrected horsepower per belt to obtain the number of belts required. In any case, furnish not less than two belts for each drive.
- B. Furnish belts that have been factory or factory-authorized distributor matched and measured on a belt-matching machine. Selection by "code numbers," "sag numbers" or "match numbers" is not acceptable. Bind each belt set with wire and tag with equipment identification.
- C. Manufacturers:
  - 1. Emerson Power Transmission; Browning; AX, BX, and CX Series and 3VX and 5VX Series.
  - 2. Rockwell Automation; Dodge; Classic Cog and Narrow Cog V-Belts.
  - 3. T.B. Wood's Incorporated; Classical Cog and Narrow Cog V-Belts.

2.9 V-BELT DRIVE MOTOR BASES

- A. Furnish fan motors with slide or adjustable pivoted bases wherever equipment configuration permits proper installation.
- B. Provide for adjustment of both belt tension and alignment.

2.10 AIR HANDLING SYSTEM BALANCING PROVISIONS

- A. Provide extra sheaves, sized as recommended by the Balancing Agent, for the adjustment of fan speed for each air handling system during air quantity balancing operations. Furnish sheaves as specified in this Section.

2.11 FLEXIBLE COUPLINGS (DIRECT DRIVE)

- A. Fan shaft shall be connected to the motor shaft through a flexible coupling. The flexible member shall be a tire shape, in shear, or a solid mass serrated edge disc shape, made of chloroprene materials and retained by fixed flanges. Flexible coupling shall act as a dielectric connector and shall not transmit sound, vibration or end thrust.
- B. Manufacturer:
  - 1. Falk Corporation (The).

2.12 MOTOR REQUIREMENTS

- A. Furnish motors in accordance with Division 20 Section "Motors."

2.13 FAN BEARINGS

- A. Bearings: Anti-friction ball or roller type with provision for self-alignment and thrust load. Made in U.S.A. with ABMA L<sub>10</sub> minimum life of 200,000 hours. Use cast iron housings and dust-tight seals suitable for lubricant pressures.
  - 1. Lubrication Provisions - Use surface ball check type supply fittings. Provide extension tubes to allow safe maintenance while equipment is operating. Provide manual or automatic pressure relief fittings to prevent overheating or seal blow-out due to excess lubricant or pressure. Arrange relief fittings opposite supply but visible for normal maintenance observation.
  - 2. Bearings on Equipment with less than 1/2 horsepower rating or on shafts smaller than 1-3/4 inch in diameter: Permanently sealed, pre-lubricated anti-friction bearings per specified materials and ABMA L<sub>10</sub> life requirements.

2.14 IDENTIFICATION

- A. Nameplate: Affix metallic, corrosion-resistant data plate for each fan in a conspicuous location. Include selection point capacity conditions.



2.15 ACCESSORIES

- A. Bird Screens: Of material to match adjacent contact construction, 1/2 inch mesh or equal expanded metal. Use on inlet or outlet of each nonducted fan.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Field Rigging: Do not negate balancing. Do not bend shaft. Use lifting eyes.
- B. Install sheaves where recommended by Testing, Adjusting, and Balancing agency.
- C. Refer to individual Division 23 HVAC equipment Sections for additional requirements.

END OF SECTION 230500

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 21 fire-suppression piping and fire pump Sections for fire-protection valves.
  - 2. Division 20 Section "Mechanical Identification" for valve tags and charts.
  - 3. Division 22 Section "General-Duty Valves for Plumbing" for plumbing valves.
  - 4. Division 23 Section "Temperature Controls" for control valves and actuators.

1.2 SUMMARY

- A. This Section includes valves for general HVAC applications. Refer to piping Sections for specialty valve applications.

### 1.3 DEFINITIONS

- A. The following are standard abbreviations for valves:
1. CWP: Cold working pressure.
  2. EPDM: Ethylene-propylene-diene terpolymer rubber.
  3. NBR: Acrylonitrile-butadiene rubber.
  4. NRS: Nonrising stem.
  5. OS&Y: Outside screw and yoke.
  6. PTFE: Polytetrafluoroethylene plastic.
  7. RPTFE: Reinforced polytetrafluoroethylene plastic.
  8. SWP: Steam working pressure.
  9. TFE: Tetrafluoroethylene plastic.
  10. WOG: Water, oil, and gas.

### 1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

### 1.5 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.9 for building services piping valves.
- B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
  2. Protect threads, flange faces, grooves, and weld ends.
  3. Set angle, gate, and globe valves closed to prevent rattling.
  4. Set ball and plug valves open to minimize exposure of functional surfaces.
  5. Set butterfly valves closed or slightly open.
  6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
1. Maintain valve end protection.
  2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

## PART 2 - PRODUCTS

### 2.1 VALVES, GENERAL

- A. Isolation valves are scheduled on the Drawings. For other general HVAC valve applications, use the following:
  - 1. Shutoff Service: Ball, butterfly valves.
  - 2. Throttling Service: Angle, ball, butterfly, or globe valves.
  - 3. Pump Discharge: Spring-loaded, lift-disc check valves; and bronze lift check valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- D. For valves not indicated in the Application Schedules, select valves with the following end connections:
  - 1. For Copper Tubing, NPS 2 and Smaller: Solder-joint or threaded ends, except provide valves with threaded ends for condenser water, heating hot water, steam, and steam condensate services.
  - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged, solder-joint, or threaded ends.
  - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
  - 4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
  - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends.
  - 6. For Steel Piping, NPS 5 and Larger: Flanged ends.
- E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- F. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- G. Valve Actuators:
  - 1. Gear Drive Operator: For quarter-turn valves NPS 8 and larger.
  - 2. Handwheel: For valves other than quarter-turn types.
  - 3. Lever Handle: For quarter-turn valves NPS 6 and smaller.
- H. Extended Valve Stems: On insulated valves.
- I. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- J. Valve Grooved Ends: AWWA C606.
- K. Solder Joint: With sockets according to ASME B16.18.
  - 1. Caution: Disassemble valves when soldering, as recommended by the manufacturer, to prevent damage to internal parts.

- L. Threaded: With threads according to ASME B1.20.1.
- M. Valve Bypass and Drain Connections: MSS SP-45.

## 2.2 BRONZE BALL VALVES

- A. Bronze Ball Valves, General: MSS SP-110 and have bronze body complying with ASTM B 584, except for Class 250 which shall comply with ASTM B 61, full-depth ASME B1.20.1 threaded or solder ends, and blowout-proof stems.
- B. Two-Piece, Regular Port Bronze Ball Valves with Stainless-Steel Trim: Type 316 stainless-steel ball and stem, reinforced TFE seats, blow-out-proof stem, with adjustable stem packing, soldered or threaded ends; and 150 psig SWP and 600-psig CWP ratings.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; by Conbraco Industries, Inc.; Series 70-140.
    - b. Crane Co.; Crane Valves.
    - c. Hammond Valve.
    - d. Milwaukee Valve Company; Model BA100S.
    - e. NIBCO INC.; Models S-580-70-66 or T-580-70-66.
    - f. Watts Water Technologies, Inc.
- C. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim: Type 316 stainless-steel ball and stem, reinforced TFE seats, blow-out-proof stem, with adjustable stem packing, soldered or threaded ends; 150 psig SWP and 600-psig CWP ratings.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; by Conbraco Industries, Inc.; Series 77C-A Series.
    - b. Crane Co.; Crane Valves.
    - c. Hammond Valve.
    - d. Milwaukee Valve Company.
    - e. NIBCO INC.; Models S-585-70-66 or T-585-70-66.
    - f. Watts Water Technologies, Inc.; Series B6080G2/B6081G2.

## 2.3 GENERAL SERVICE BUTTERFLY VALVES

- A. General: MSS SP-67, for bubble-tight shutoff, extended-neck for insulation, disc and lining suitable for potable water, unless otherwise indicated, and with the following features:
  - 1. Full lug, and grooved valves shall be suitable for bi-directional dead end service at full rated pressure without the use or need of a downstream flange.
  - 2. Valve sizes NPS 2 through NPS 6 shall have lever lock operator; valve sizes NPS 8 and larger shall have weatherproof gear operator.
- B. Lug-Style (Single-Flange) Size NPS 2-1/2 through NPS 12, 200-psig CWP Rating, Aluminum-Bronze Disc, EPDM Seat, Ferrous-Alloy Butterfly Valves: Full-lug type with ductile-iron body, Type 416 stainless-steel stem, copper bushing, aluminum-bronze disc, and molded-in EPDM seat (liner).

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Apollo Valves; by Conbraco Industries, Inc.; Series 143 and Series LD 145.
- b. Bray International, Inc.
- c. DeZurik.
- d. Forum Energy Technologies; ABZ Valve.
- e. Hammond Valve.
- f. Milwaukee Valve Company.
- g. NIBCO INC.; LD-2000-3/5.
- h. Pentair Valves & Controls; Keystone.
- i. Tyco Flow Control; Grinnell Flow Control.
- j. Watts Water Technologies.

- C. Lug-Style (Single-Flange) Size NPS 14 and Larger, 150-psig CWP Rating, Aluminum-Bronze Disc, EPDM Seat, Ferrous-Alloy Butterfly Valves: Full-lug type with ductile-iron body, one- or two-piece Type 416 stainless-steel stem, bronze bushing, and phenolic-backed EPDM seat (liner) attached to the body.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Apollo Valves; by Conbraco Industries, Inc.; Series 143 and Series LD 145.
- b. Bray International, Inc.
- c. Dezurik.
- d. Forum Energy Technologies; ABZ Valve.
- e. Hammond Valve.
- f. Milwaukee Valve Company.
- g. NIBCO INC.; LD-1000-5.
- h. Pentair Valves & Controls; Keystone.
- i. Tyco Flow Control; Grinnell Flow Control.
- j. Watts Water Technologies.

## 2.4 BRONZE CHECK VALVES

- A. Bronze Check Valves, General: MSS SP-80.
- B. Class 150, Bronze, Swing Check Valves with Bronze Disc: ASTM B-62 bronze body and seat with regrinding-type bronze disc, Y-pattern design, soldered or threaded end connections, and having 300 psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Apollo Valves; by Conbraco Industries, Inc.
- b. Crane Co.; Crane Valves.
- c. Crane Co.; Stockham Div.
- d. Hammond Valve.
- e. Milwaukee Valve Company; Model 515.
- f. NIBCO INC.; Models S-433-B or T-433-B.
- g. Watts Water Technologies.

## 2.5 IRON SWING CHECK VALVES

- A. Iron Swing Check Valves, General: MSS SP-71.

- B. Class 125, Gray-Iron, Standard Swing Check Valves: ASTM A-126, Class B cast-iron body and bolted bonnet with flanged end connections; non-asbestos synthetic-fiber gaskets; bronze disc and seat; and having 200 psig CWP rating.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; by Conbraco Industries, Inc.
    - b. Crane Co.; Crane Valves.
    - c. Crane Co.; Stockham Div.
    - d. Hammond Valve.
    - e. Milwaukee Valve Company; Model F-2974.
    - f. NIBCO INC.; Model F-918-B.
    - g. Watts Water Technologies.
  
- C. Class 250, Gray-Iron, Swing Check Valves: ASTM A-126, Class B cast-iron body and bolted bonnet with flanged end connections; non-asbestos synthetic-fiber gaskets; and bronze disc and seat; and having 500 psig CWP rating.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; by Conbraco Industries, Inc.
    - b. Crane Co.; Crane Valves.
    - c. Crane Co.; Stockham Div.
    - d. Hammond Valve.
    - e. Milwaukee Valve Company; Model F-2970.
    - f. NIBCO INC.; Model F-968-B.
    - g. Watts Water Technologies.

## 2.6 BRONZE LIFT CHECK VALVES

- A. Class 125, Lift Check Valves with Nonmetallic TFE Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hammond Valve.
    - b. Milwaukee Valve Company.
    - c. NIBCO INC.; Model S-480-Y or T-480-Y.
    - d. The Wm. Powell Company.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 2.
    - b. CWP Rating: 250 psig.
    - c. Body Design: Vertical flow.
    - d. Body Material: ASTM B 584 Alloy C844, bronze.
    - e. Ends: Threaded or Solder.
    - f. Disc: PTFE, or TFE.

## 2.7 SPRING-LOADED, CENTER-GUIDED LIFT-DISC (SILENT) CHECK VALVES

- A. Lift-Disc Check Valves, General: FCI 74-1 and MIL-V-18436F, with spring-loaded, center-guided bronze disc and seat.

- B. Class 125, Wafer, Lift-Disc Check Valves: Wafer style with cast-iron body with diameter made to fit within bolt circle, and having 200 psig CWP rating.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. NIBCO INC.; Model W-910-B.
    - b. Mueller Steam Specialty.
    - c. Milwaukee Valve Company.
    - d. Hammond Valve.
- C. Class 250, Wafer, Lift-Disc Check Valves: Wafer style with cast-iron body with diameter made to fit within bolt circle, and having 400 psig CWP rating.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. NIBCO INC.; Model W-960-B.
    - b. Mueller Steam Specialty.
    - c. Milwaukee Valve Company.
    - d. Hammond Valve.
- D. Class 125, Globe, Flanged Lift-Disc Check Valves: Globe style with cast-iron body and flanged ends, and having 200 psig CWP rating.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. NIBCO INC.; Model F-910-B.
    - b. Mueller Steam Specialty.
    - c. Milwaukee Valve Company.
    - d. Hammond Valve.
- E. Class 250, Globe, Flanged Lift-Disc Check Valves: Globe style with cast-iron body and flanged ends, and having 400 psig CWP rating.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. NIBCO INC.; Model F-960-B.
    - b. Mueller Steam Specialty.
    - c. Milwaukee Valve Company.
    - d. Hammond Valve.

## 2.8 BRONZE GLOBE VALVES

- A. Bronze Globe Valves, General: MSS SP-80, with malleable-iron handwheel.
- B. Class 150, TFE Disc, Bronze Globe Valves: ASTM B-62 bronze body, bonnet, and seat, TFE disc, copper-silicone bronze stem, union-ring bonnet, soldered or threaded end connections; and having 300 psig CWP rating.
  - 1. Manufacturers: Subject to compliance with requirements, Provide products by one of the following:



- a. Apollo Valves; by Conbraco Industries, Inc.
- b. Crane Co.; Crane Valves.
- c. Hammond Valve.
- d. Milwaukee Valve Company; Model 590.
- e. NIBCO INC.; Models S-235-Y or T-235-Y.
- f. Watts Water Technologies, Inc.

## 2.9 CAST-IRON GLOBE VALVES

- A. Cast-Iron Globe Valves, General: MSS SP-85 with bolted bonnet, flanged end connections, and non-asbestos packing and gasket.
- B. Class 125, Metal Seat, Cast-Iron Globe Valves: ASTM A-126, Class B cast-iron body and bonnet with bronze trim and having 200 psig CWP rating.
  1. Manufacturers: Subject to compliance with requirements, Provide products by one of the following:
    - a. Apollo Valves; by Conbraco Industries, Inc.
    - b. Crane Co.; Crane Valves.
    - c. Crane Co.; Stockham Valves.
    - d. Hammond Valve.
    - e. Milwaukee Valve Company; Model F-2981.
    - f. NIBCO INC.; Model F-718-B.
    - g. Watts Water Technologies, Inc.

## 2.10 BRONZE ANGLE VALVES

- A. Bronze Angle Valves, General: MSS SP-80, with silicon bronze stem, non-asbestos packing and malleable-iron handwheel.
- B. Class 150, Bronze Angle Valves: ASTM B 62 bronze body with TFE disc, union-ring bonnet, threaded ends, and having 300-psig CWP rating.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valves.
    - b. Crane Co.; Stockham Valves.
    - c. Hammond Valve.
    - d. Milwaukee Valve Company; Model 595T.
    - e. NIBCO INC.; Model T-335-Y.
    - f. The Wm. Powell Company.

## 2.11 CAST-IRON ANGLE VALVES

- A. Cast-Iron Angle Valves, General: MSS SP-85, Type II; having ASTM A 126, Class B cast-iron body and bolted bonnet; bronze mounted, non-asbestos packing and gaskets; and flanged-end connections.

- B. Class 125, Cast-Iron, Standard Angle Valves: 200-psig CWP rating.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. NIBCO INC.; Model F-818-B.
    - b. Crane Co.; Stockham Valves.
    - c. Crane Co.; Crane Valves.

## 2.12 DRAIN VALVES

- A. Ball-Valve-Type, Hose-End Drain Valves:
  - 1. Bronze ball valve as specified in this Section.
  - 2. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 20 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe. Butterfly valves shall be installed with stem horizontal to allow support for the disc and the cleaning action of the disc.
- E. Install valves in position to allow full stem movement.
- F. Install chainwheel operators on valves NPS 4 and larger and more than 84 inches above floor. Extend chains to 60 inches above finished floor elevation.
- G. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.
  - 2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
  - 3. Lift Check Valves: With stem upright and plumb.

### 3.3 JOINT CONSTRUCTION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

### 3.4 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 230523

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 23 Section "Common Work Results for HVAC."

1.2 SUMMARY

- A. This Section includes testing, adjusting, and balancing to produce design objectives for the following:
  - 1. Air Systems:

- a. Variable-air-volume systems.
  2. Hydronic Piping Systems:
    - a. Variable-flow systems.
    - b. Primary-secondary systems.
  3. HVAC equipment quantitative-performance settings.
  4. Verifying that automatic control devices are functioning properly.
  5. Reporting results of activities and procedures specified in this Section.
- B. Include rebalancing of air systems, or system portions affected by recommended sheave changes.

### 1.3 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. AHJ: Authority having jurisdiction.
- C. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.
- D. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.
- E. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- F. NC: Noise criteria.
- G. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- H. RC: Room criteria.
- I. Report Forms: Test data sheets for recording test data in logical order.
- J. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- K. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- L. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- M. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- N. TAB: Testing, adjusting, and balancing.

- O. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- P. Test: A procedure to determine quantitative performance of systems or equipment.
- Q. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

#### 1.4 SUBMITTALS

- A. Qualification Data: Within 15 days from Contractor's Notice to Proceed, submit 4 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 15] days from Contractor's Notice to Proceed, submit 4 copies of the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 30 days from Contractor's Notice to Proceed, submit 4 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.
- D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.
- E. Sample Report Forms: Submit two sets of sample TAB report forms.
- F. Warranties specified in this Section.

#### 1.5 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.
- B. Approved Balancing Agencies.
  - 1. The TAB firm selected shall be from the following list:
    - a. Absolut Balance Company, Inc.; South Lyon, MI.
    - b. Air Solutions, Inc.; Lapeer, MI.
    - c. Airflow Testing Inc.; Lincoln Park, MI.
    - d. Barmatic Inspecting Co., Inc.; Lincoln Park, MI.
    - e. Control Solutions, Inc.; Byron Center, MI.
    - f. Ener-Tech Testing; Holly, MI.
    - g. Enviro-Aire/Total Balance Co.; St. Clair Shores, MI.
    - h. International Test & Balance Inc.; Southfield, MI.
    - i. Quality Air Service; Portage, MI.
    - j. Pro-MEC Engineering Services, Inc.; Grand Ledge, MI.
    - k. Hi-Tech Test & Balance; Freeland, MI.
    - l. Integrity Test & Balance, Inc.; Cedar, MI.
- C. TAB Conference: Meet with Owner's and Architect's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers'

authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items: Include at least the following:

- a. Submittal distribution requirements.
- b. The Contract Documents examination report.
- c. TAB plan.
- d. Work schedule and Project-site access requirements.
- e. Coordination and cooperation of trades and subcontractors.
- f. Coordination of documentation and communication flow.

D. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

E. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems." TAB firm's forms approved by Architect.

F. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

G. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.

1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

## 1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

## 1.7 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

- B. Notice: Provide seven days advance notice for each test. Include scheduled test dates and times.
- C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

## 1.8 WARRANTY

- A. National Project Performance Guarantee: If AABC standards are used, provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
  - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
  - 2. Systems are balanced to optimum performance capabilities within design and installation limits.
- B. Special Guarantee: If NEBB standards are used, provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:
  - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
  - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

## PART 2 - PRODUCTS (NOT APPLICABLE)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- B. Examine system and equipment test reports.
- C. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- D. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.



- E. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.
- F. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.
- G. Examine strainers for clean screens and proper perforations.
- H. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- I. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- J. Examine system pumps to ensure absence of entrained air in the suction piping.
- K. Examine equipment for installation and for properly operating safety interlocks and controls.
- L. Examine automatic temperature system components to verify the following:
  - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
  - 2. Dampers and valves are in the position indicated by the controller.
  - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
  - 4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
  - 5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
  - 6. Sensors are located to sense only the intended conditions.
  - 7. Sequence of operation for control modes is according to the Contract Documents.
  - 8. Controller set points are set at indicated values.
  - 9. Interlocked systems are operating.
  - 10. Changeover from heating to cooling mode occurs according to indicated values.
- M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### 3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Perform the following field tests and inspections to new and renovated portions of duct systems according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:
  - 1. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.

2. Maximum Allowable Leakage: Leakage rates are scheduled on the Drawings.
- C. Complete system readiness checks and prepare system readiness reports. Verify the following:
1. Permanent electrical power wiring is complete.
  2. Hydronic systems are filled, clean, and free of air.
  3. Automatic temperature-control systems are operational.
  4. Equipment and duct access doors are securely closed.
  5. Balance, smoke, and fire dampers are open.
  6. Isolating and balancing valves are open and control valves are operational.
  7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  8. Windows and doors can be closed so indicated conditions for system operations can be met.

### 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
- B. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.
- C. Take and report testing and balancing measurements in inch-pound (IP) units.

### 3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts, or use reduced scale contract documents with notations.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- E. Cut insulation, and drill ducts for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes with neat patches, neoprene plugs, threaded plugs, or threaded twist-on metal caps, and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- F. Check air flow within intake plenums and mixing boxes of air handling units for uneven flow and temperature stratification and prepare a report with profile elevations (temperature and velocity) on each coil or filter face for Architect.

- G. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- H. Verify that motor starters are equipped with properly sized thermal protection.
- I. Check dampers for proper position to achieve desired airflow path.
- J. Check for airflow blockages.
- K. Check condensate drains for proper connections and functioning.
- L. Check for proper sealing of air-handling unit components.
- M. Check for proper sealing of air duct system.

### 3.5 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
  - 1. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.
  - 2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
  - 3. Measure total system airflow. Adjust to within indicated airflow.
  - 4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
  - 5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow.
    - a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
  - 6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
  - 7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
  - 8. Record the final fan performance data.

### 3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts, or use reduced scale contract documents with notations.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
  - 1. Open all manual valves for maximum flow.
  - 2. Check expansion tank liquid level.
  - 3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
  - 4. Check flow-control valves for specified sequence of operation and set at indicated flow.
  - 5. Set system controls so automatic valves are wide open to heat exchangers.
  - 6. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
  - 7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.

### 3.7 PROCEDURES FOR HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures, except for positive-displacement pumps:
  - 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
  - 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
  - 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
  - 4. Report flow rates that are not within plus or minus 5 percent of design.
- B. Set calibrated balancing valves, if installed, at calculated presettings.
- C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
  - 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.
  2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
  3. Record settings and mark balancing devices.
- F. Equipment installed with pressure independent characterized control valves (PICCV) or auto-flow devices shall not require hydronic system balancing unless multiple coils are served from a single PICCV or auto-flow device (Example: AHU coil banks with multiple coils). Measure flow through each PICCV and auto-flow device and compare measured value to scheduled value to verify proper valve/device was installed and valve is functional. Verify flow for 100 percent of PICCV and auto-flow devices. Report discrepancies.
- G. Chilled beams do not require individual hydronic balancing. Verify proper flow is achieved through balancing or control device serving chilled beam control zone. Report discrepancies.
- H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- I. Measure the differential-pressure control valve settings existing at the conclusions of balancing, and record in report.

### 3.8 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance variable-flow hydronic systems by following the "Proportional Balancing Procedure" in accordance with NEBB.
- B. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

### 3.9 PROCEDURES FOR PRIMARY-SECONDARY-FLOW HYDRONIC SYSTEMS

- A. Balance the primary system crossover flow first, then balance the secondary system.

### 3.10 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Water Coils: Measure the following data for each coil:
  1. Entering- and leaving-water temperature.
  2. Water flow rate.
  3. Water pressure drop.
  4. Dry-bulb temperature of entering and leaving air.
  5. Wet-bulb temperature of entering and leaving air for cooling coils.
  6. Airflow.
  7. Air pressure drop.

### 3.11 PROCEDURES FOR TEMPERATURE MEASUREMENTS

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

### 3.12 PROCEDURES FOR LABORATORY FUME HOODS

- A. Before performing laboratory fume hood testing, measure, adjust and record the supply airflow and airflow patterns of each supply air outlet that is located in the same room as the hood. Adjust the air outlet flow pattern to minimize turbulence and to achieve the desired airflow patterns at the face and inside the hood. Verify that adequate makeup air is available to achieve the indicated flow of the hood.
- B. Measure, adjust, and record the airflow of each laboratory fume hood by duct Pitot-tube traverse with the laboratory fume hood sash in the design open position.
  - 1. For laboratory fume hoods installed in variable exhaust systems, measure, adjust, and record the hood exhaust airflow at maximum and at minimum airflow conditions.
  - 2. For laboratory fume hoods designed with integral makeup air, measure, adjust, and record the exhaust and makeup airflow.
  - 3. Verify that no air is by-passed within hood. Report if baffles require modification at designated sash height.
- C. For laboratory fume hoods that are connected to centralized exhaust systems using automatic dampers, adjust the damper controller to obtain the indicated exhaust airflow.
- D. After balancing is complete, do the following:
  - 1. Measure and record the static pressure at the hood duct connection with the hood operating at indicated airflow.
  - 2. Measure and record the face velocity across the open sash face area. Measure the face velocity at each point in a grid pattern. Perform measurements at a maximum of 12 inches between points and between any point and the perimeter of the opening.
    - a. For laboratory fume hoods designed to maintain a constant face velocity at varying sash positions, also measure and record the face velocity at 50 and 25 percent of the design open sash position.
    - b. Calculate and report the average face velocity by averaging all velocity measurements.
    - c. Calculate and report the exhaust airflow by multiplying the calculated average face velocity by the sash open area. Compare this quantity with the exhaust airflow measured by duct Pitot-tube traverse. Report differences.
    - d. If the average face velocity is less than the indicated face velocity, retest the average face velocity and adjust hood baffles, fan drives, and other parts of the system to provide the indicated average face velocity.

3. Check each laboratory fume hood for the capture and containment of smoke by using a hand-held emitting device. Observe the capture and containment of smoke flow pattern across the open face and inside the hood. Make adjustments necessary to achieve the desired results.

### 3.13 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
  1. Measure and record the operating speed, airflow, and static pressure of each fan.
  2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
  3. Check the condition of filters.
  4. Check the condition of coils.
  5. Check the operation of the drain pan and condensate drain trap.
  6. Check bearings and other lubricated parts for proper lubrication.
  7. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished.
  1. New filters are installed.
  2. Coils are clean and fins combed.
  3. Drain pans are clean.
  4. Fans are clean.
  5. Bearings and other parts are properly lubricated.
  6. Deficiencies noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
  1. Compare the indicated airflow of the renovated work to the measured fan airflows and determine the new fan, speed, filter, and coil face velocity.
  2. If calculations increase or decrease the airflow and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated airflow and water flow rates. If 5 percent or less, equipment adjustments are not required.
  3. Air balance each air outlet.

### 3.14 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
  1. Air handling equipment and outlets: Plus or minus 5 percent.
    - a. Where terminal units serve 6 or more outlets within a common room, individual outlets may vary up to plus or minus 10 percent of design flow rates if overall room supply is within plus or minus 5 percent.
  2. Heating-Water Flow Rate: 0 to minus 10 percent.
  3. Cooling-Water Flow Rate: 0 to plus 5 percent.

### 3.15 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

### 3.16 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
  - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to certified field report data, include the following:
  - 1. Pump curves.
  - 2. Fan curves.
  - 3. Manufacturers' test data.
  - 4. Field test reports prepared by system and equipment installers.
  - 5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
  - 1. Title page.
  - 2. Name and address of TAB firm.
  - 3. Project name.
  - 4. Project location.
  - 5. Architect's name and address.
  - 6. Engineer's name and address.
  - 7. Contractor's name and address.
  - 8. Report date.
  - 9. Signature of TAB firm who certifies the report.
  - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  - 11. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.



12. Nomenclature sheets for each item of equipment.
  13. Notes to explain why certain final data in the body of reports varies from indicated values.
  14. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outside-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Face and bypass damper settings at coils.
    - e. Fan drive settings including settings and percentage of maximum pitch diameter.
    - f. Inlet vane settings for variable-air-volume systems.
    - g. Settings for supply-air, static-pressure controller.
    - h. Other system operating conditions that affect performance.
- E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outside, supply, return, and exhaust airflows.
  2. Water flow rates.
  3. Terminal units.
  4. Balancing stations.
- F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data: Include the following:
    - a. Unit identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Unit arrangement and class.
    - g. Discharge arrangement.
    - h. Sheave make, size in inches, and bore.
    - i. Sheave dimensions, center-to-center, and amount of adjustments in inches.
    - j. Number of belts, make, and size.
    - k. Number of filters, type, and size.
  2. Motor Data:
    - a. Make and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
    - g. Power factor efficiency.
  3. Test Data (Indicated and Actual Values):
    - a. Total airflow rate in cfm.
    - b. Total system static pressure in inches wg.
    - c. Fan rpm.

- d. Discharge static pressure in inches wg.
- e. Filter static-pressure differential in inches wg.
- f. Preheat coil static-pressure differential in inches wg.
- g. Cooling coil static-pressure differential in inches wg.
- h. Heating coil static-pressure differential in inches wg.
- i. Outside airflow in cfm.
- j. Return airflow in cfm.
- k. Outside-air damper position.
- l. Return-air damper position.
- m. Vortex damper position.

G. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
- b. Location.
- c. Coil type.
- d. Number of rows.
- e. Fin spacing in fins per inch o.c.
- f. Make and model number.
- g. Face area in sq. ft.
- h. Tube size in NPS.
- i. Tube and fin materials.
- j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm.
- b. Average face velocity in fpm.
- c. Air pressure drop in inches wg.
- d. Outside-air, wet- and dry-bulb temperatures in deg F.
- e. Return-air, wet- and dry-bulb temperatures in deg F.
- f. Entering-air, wet- and dry-bulb temperatures in deg F.
- g. Leaving-air, wet- and dry-bulb temperatures in deg F.
- h. Water flow rate in gpm.
- i. Water pressure differential in feet of head or psig.
- j. Entering-water temperature in deg F.
- k. Leaving-water temperature in deg F.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and size.
- e. Manufacturer's serial number.
- f. Arrangement and class.
- g. Sheave make, size in inches, and bore.
- h. Sheave dimensions, center-to-center, and amount of adjustments in inches.

2. Motor Data:

- a. Make and frame type and size.

- b. Horsepower and rpm.
  - c. Volts, phase, and hertz.
  - d. Full-load amperage and service factor.
  - e. Sheave make, size in inches, and bore.
  - f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
  - g. Number of belts, make, and size.
3. Test Data (Indicated and Actual Values):
- a. Total airflow rate in cfm.
  - b. Total system static pressure in inches wg.
  - c. Fan rpm.
  - d. Discharge static pressure in inches wg.
  - e. Suction static pressure in inches wg.
- I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
    - a. System and air-handling unit number.
    - b. Location and zone.
    - c. Traverse air temperature in deg F.
    - d. Duct static pressure in inches wg.
    - e. Duct size in inches.
    - f. Duct area in sq. ft.
    - g. Indicated airflow rate in cfm.
    - h. Indicated velocity in fpm.
    - i. Actual airflow rate in cfm.
    - j. Actual average velocity in fpm.
    - k. Barometric pressure in psig.
- J. Air-Terminal-Device Reports:
1. Unit Data:
    - a. System and air-handling unit identification.
    - b. Location and zone.
    - c. Test apparatus used.
    - d. Area served.
    - e. Air-terminal-device make.
    - f. Air-terminal-device number from system diagram.
    - g. Air-terminal-device type and model number.
    - h. Air-terminal-device size.
    - i. Air-terminal-device effective area in sq. ft.
  2. Test Data (Indicated and Actual Values):
    - a. Airflow rate in cfm.
    - b. Air velocity in fpm.
    - c. Preliminary airflow rate as needed in cfm.
    - d. Preliminary velocity as needed in fpm.
    - e. Final airflow rate in cfm.
    - f. Final velocity in fpm.
    - g. Space temperature in deg F.

- K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data:
    - a. System and air-handling unit identification.
    - b. Location and zone.
    - c. Room or riser served.
    - d. Coil make and size.
    - e. Flowmeter type.
  2. Test Data (Indicated and Actual Values):
    - a. Airflow rate in cfm.
    - b. Entering-water temperature in deg F.
    - c. Leaving-water temperature in deg F.
    - d. Water pressure drop in feet of head or psig.
    - e. Entering-air temperature in deg F.
    - f. Leaving-air temperature in deg F.
  3. Test Data (Indicated and Actual Values):
    - a. Inlet-duct static pressure in inches wg.
    - b. Outlet-duct static pressure in inches wg.
    - c. Entering-air, dry-bulb temperature in deg F.
    - d. Leaving-air, dry-bulb temperature in deg F.
    - e. Condenser entering-water temperature in deg F.
    - f. Condenser leaving-water temperature in deg F.
    - g. Condenser-water temperature differential in deg F.
    - h. Condenser entering-water pressure in feet of head or psig.
    - i. Condenser leaving-water pressure in feet of head or psig.
    - j. Condenser-water pressure differential in feet of head or psig.
    - k. Control settings.
    - l. Voltage at each connection.
    - m. Amperage for each phase.
    - n. Kilowatt input.
    - o. Crankcase heater kilowatt.
    - p. Number of fans.
    - q. Condenser fan rpm.
    - r. Condenser fan airflow rate in cfm.
    - s. Condenser fan motor make, frame size, rpm, and horsepower.
    - t. Condenser fan motor voltage at each connection.
    - u. Condenser fan motor amperage for each phase.
  4. Water Test Data (Indicated and Actual Values):
    - a. Entering-water temperature in deg F.
    - b. Leaving-water temperature in deg F.
    - c. Water temperature differential in deg F.
    - d. Entering-water pressure in feet of head or psig.
    - e. Leaving-water pressure in feet of head or psig.
    - f. Water pressure differential in feet of head or psig.
    - g. Water flow rate in gpm.
    - h. Bleed water flow rate in gpm.
  5. Air Data (Indicated and Actual Values):

- a. Duct airflow rate in cfm.
- b. Inlet-duct static pressure in inches wg.
- c. Outlet-duct static pressure in inches wg.
- d. Average entering-air, wet-bulb temperature in deg F.
- e. Average leaving-air, wet-bulb temperature in deg F.
- f. Ambient wet-bulb temperature in deg F.

L. Air-to-Air Heat-Recovery Unit Reports:

1. Unit Data:

- a. Unit identification.
- b. Location.
- c. Service.
- d. Make and type.
- e. Model and serial numbers.

2. Motor Data:

- a. Make and frame type and size.
- b. Horsepower and rpm.
- c. Volts, phase, and hertz.
- d. Full load amperage and service factor.
- e. Sheave make, size in inches, and bore.
- f. Sheave dimensions, center-to-center, and amount of adjustments in inches.

3. If fans are an integral part of the unit, include the following for each fan:

- a. Make and type.
- b. Arrangement and size.
- c. Sheave make, size in inches, and bore.
- d. Sheave dimensions, center-to-center, and amount of adjustments in inches.

4. Test Data (Indicated and Actual Values):

- a. Total exhaust airflow rate in cfm.
- b. Purge exhaust airflow rate in cfm.
- c. Outside airflow rate in cfm.
- d. Total exhaust fan static pressure in inches wg.
- e. Total outside-air fan static pressure in inches wg.
- f. Pressure drop on each side of recovery wheel in inches wg.
- g. Exhaust air temperature entering in deg F.
- h. Exhaust air temperature leaving in deg F.
- i. Outside-air temperature entering in deg F.
- j. Outside-air temperature leaving in deg F.
- k. Calculate sensible and total heat capacity of each airstream in MBh.

3.17 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.

2. Randomly check the following for each system:
  - a. Measure airflow of at least 10 percent of air outlets.
  - b. Measure water flow of at least 5 percent of terminals.
  - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
  - d. Measure sound levels at two locations.
  - e. Measure space pressure of at least 10 percent of locations.
  - f. Verify that balancing devices are marked with final balance position.
  - g. Note deviations to the Contract Documents in the Final Report.

B. Final Inspection:

1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by engineer.
2. TAB firm test and balance engineer shall conduct the inspection in the presence of Engineer.
3. Engineer shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.18 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230933 - TEMPERATURE CONTROLS

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## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 23 Section "Testing, Adjusting, and Balancing."

### 1.2 SUMMARY

- A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

### 1.3 DEFINITIONS

- A. BACnet: Communications open protocol for building automation system networks and control (developed by ASHRAE and documented per ANSI/ASHRAE Standard 135-2012).
- B. BAS: Building Automation System
- C. CAD: Computer Aided Design.
- D. DDC: Direct-digital controls.
- E. TC: Temperature Control.

### 1.4 SYSTEM DESCRIPTION

- A. Temperature control system consisting of native, BACnet, direct digital control system controllers, sensors, transducers, relays, switches, data communication network, etc. and all associated control wiring and raceway systems. All BACnet controllers to be BTL certified.
- B. Provide new Tridium Niagara N4 system supervisory server application software, licensing, etc., as new BAS front-end for BAS/DDC system operators. Software is to be installed on Owner's IT network that is to be coordinated by Temperature Control Contractor.
- C. Provide required quantity of Network Supervisory Controllers (NSC) employing BACnet MS/TP communication with capacity connect to all HVAC packaged equipment controllers and new controllers added during this project. NSC(s) shall be sized appropriately per application to handle the required quantity of connected controllers and devices. IP connection shall be provided by the Owner's IT staff. NSC shall have 25% additional spare node addresses for future expansion.



- D. Provide controller “discovery” process, point mapping from HVAC packaged equipment and new controllers to the Tridium N4 platform. Provide custom programming required for scheduling and setpoint adjustment capability of all controllers. Provide new graphics with an area map of all schools in the district indicating which are connected to the new Tridium N4 platform, floor-by-floor graphics with icons for controlled equipment, link to the mechanical equipment under control. Provide a graphical link to the sequence of operation for each system being controlled.
- E. Integration of 3<sup>rd</sup> party BACnet, DDC controllers where indicated on the construction documents.
- F. Provide BAS Controller Service Tool Software to be installed on Owner provided PC laptops. Provide data cables required.
- G. Electric thermostats, control valves, dampers, operators, control wiring, etc.
- H. Gauges, indicating devices, electric and electronic control accessories, and other control system devices.

#### 1.5 SEQUENCE OF OPERATION

- A. Control sequences for HVAC systems, subsystems, and equipment are indicated on project drawings.

#### 1.6 SUBMITTALS

- A. Submit under Division 20 and 23 provisions of respective project and as supplemented in this section.
- B. All control submittal requirements shall be submitted at one time with exception to control valves, automated dampers, and initial phases of work associated with fast-track projects (when required). Early submittals of control valve and automated dampers shall be incorporated with the complete temperature controls submittal.
- C. Product Data: Include manufacturer’s technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
  - 1. Each control device labeled with setting or adjustable range of control
- D. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- E. Shop Drawings:
  - 1. Shop drawings shall be done on CAD. Minimum size 11” x 17”.
  - 2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
  - 3. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

4. Details of control enclosure including panel faces and interior, including controls, instruments, terminations blocks and component labeling.
  5. Written sequence of operation for each controlled system.
  6. Schedule of dampers including size, leakage, and flow characteristics (Refer to Design Data).
  7. Schedule of valves including leakage and flow characteristics (Refer to Design Data).
  8. Complete bill of materials to identify and quantify all control components
  9. Overall system schematic showing communication trunk cabling from Building Network Supervisory Controller(s) to BAS field level controllers including component locations and wire termination details.
  10. DDC controller layouts showing connected data points and LAN connections. DDC controller terminations including power supply and remote control component termination details shall be provided.
  11. Point list for each DDC controller including point descriptions and addresses. This information may be incorporated with DDC controller layouts.
  12. List of system graphics to be provided with proposed tree diagram of graphics organization. Items to include: Each system, floor plan.
- F. Graphic Displays: One month after TC Shop Drawing submittal, TC Contractor shall submit graphical display backgrounds for preliminary Engineer review. Concept for each floor plan, each system, each terminal unit template. Engineer understands that final representation of graphics may not be available until BAS database is established during course of construction. Thorough graphics review will be conducted by Engineer as part of the TC/BAS acceptance procedure.
- G. Design Data: Provide indicated component selection and sizing criteria for the following component categories:
1. Control valves:
    - a. Component tag.
    - b. Equipment served/function.
    - c. Media type.
    - d. Design flow rate (GPM).
    - e. Design pressure drop (ft. head) or (psi), where applicable.
    - f. Calculated valve Cv, where applicable.
    - g. Selected valve Cv, where applicable.
    - h. Resultant pressure drop (ft. head) or (psi) with selected valve.
    - i. Valve size.
    - j. Line size to valve connection (excluding reducers).
    - k. Type (ball, butterfly, globe, etc.).
    - l. Configuration (2-way, 3-way mixing, 3-way diverting).
    - m. Normal position (normally open, normally closed, floating).
    - n. Actuator spring range (where applicable).
    - o. Actuator power requirement.
    - p. Valve shut-off rating (ft. head) or (psi)
    - q. Valve body pressure/temperature rating.
    - r. Valve manufacturer/model number.
    - s. Actuator manufacturer/model number.
  2. Dampers:
    - a. Component tag.
    - b. Equipment served/function.
    - c. Overall damper size (inch width x inch height).
    - d. Quantity of damper sections with respective size(s):
    - e. Material and gauge of thickness.

- f. Mounting orientation (horizontal or vertical).
  - g. Blade configuration (parallel or opposed)
  - h. Pressure drop (in. WG).
  - i. Shut-off rating/differential pressure rating (in. wg).
  - j. Leakage rating (CFM/sq.ft. at 4 in. wg).
  - k. Normal position (normally open, normally closed, floating).
  - l. Actuator spring range (where applicable).
  - m. Actuator power requirement.
  - n. Actuator torque requirement.
  - o. Actuator quantity.
  - p. Damper manufacturer/model number.
  - q. Actuator manufacturer/model number.
- H. Wall mounted temperature sensor, thermostat and/or other temperature control device cover color shall be coordinated to match color of wall mounted electrical device components and cover plates provided for each building renovation project - coordinate with electrical contractor for respective project. Provide samples of available temperature control device cover colors to Architect upon request or if available temperature control device colors do not match electrical device colors so a desired color selection may be determined. Provide sample of temperature sensor/thermostat guard upon request of Architect, Engineer or Owner.
- I. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- J. Submit field reports indicating operating conditions after detailed check out of systems at Date of Substantial Completion.
- K. Project Record Documents: Include the following:
1. Revise Shop Drawings to reflect actual installation and operating sequences.
  2. Record actual locations of control components, including control units, thermostats, and sensors.
  3. Submit the electronic files for all as-built shop drawings on diskette in pdf format.
- L. Software and Firmware Operational Documentation: Include the following:
1. DDC controller keypad operating instructions and DDC controller override features, where applicable.
  2. Device address list.
  3. Program Software Backup: On a magnetic media or compact disc, complete with data files.
  4. Software license required by and installed for DDC workstations and control systems.
  5. BAS Advanced instructions for scheduling equipment, trending data, displaying graphics, commanding points, adding/deleting/modifying points, changing setpoints, and setting up alarms.
  6. Advanced BAS operating instructions for graphics generation, control sequence programming and program modification.
  7. Printout of software applications and graphic screens.
- M. Maintenance Manuals: Include the following:
1. Product data with installation details, maintenance instructions and lists of spare parts for each type of control device.
  2. Keypad illustrations and step-by-step procedures indexed for each operator function, where applicable.

3. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
4. Calibration records and list of set points.

#### 1.7 REFERENCES

- A. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
- B. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure fittings.
- C. ANSI/ASTM B32 - Solder Metal.
- D. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- E. ANSI/NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- F. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- G. ASTM B75 - Seamless Copper Tube for General Engineering Purposes.
- H. ASTM D1693 - Environmental Stress - Cracking of Ethylene Plastics.
- I. NEMA DC 3 - Low-Voltage Room Thermostats.
- J. UL 1820 - Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics Only.

#### 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is a certified installer of the automatic control system manufacturer for both installation and maintenance of units required for this Project.
- B. Manufacturer Qualifications: A firm experienced in manufacturing automatic temperature-control systems similar to those indicated for this Project and with a record of successful in-service performance.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."

#### 1.9 COORDINATION

- A. Coordinate work under Division 20 and 23 provisions and as supplemented in this section.
- B. Coordinate location of space temperature sensors, space humidity sensor, thermostats, and other exposed control sensors with plans and room details before installation.

- C. Coordinate installation of system components with installation of mechanical systems and equipment to achieve compatibility.
- D. Ensure installation of components is complementary to installation of similar components in other systems.
- E. Coordinate control wiring requirements, including actual terminal block numbers, with mechanical equipment manufacturers or suppliers.
- F. Ensure control system installation is complete, checked, tested and functioning properly prior to system balancing and Owner/Engineer system checkout.
- G. Cooperate fully with the Test and Balance Contractor associated with each building renovation project and provide labor to operate the temperature control system as required to meet the scope of work defined in Division 23 Section "Testing, Adjusting and Balancing."

#### 1.10 WARRANTY

- A. Provide warranty per Division 20 Section "General Mechanical Requirements" and as supplemented in this section.
- B. Provide 24 hour per day emergency service during warranty period, with maximum response period of four (4) hours. Provide phone number(s) for quick assistance by a Service Engineer regarding hardware or software problems.
- C. Provide scheduled maintenance service during warranty period to inspect, calibrate, and adjust controls. Make a minimum of one eight hour service call every three months. Notify Owner prior to each scheduled inspection trip. Submit written reports upon completion of service.
- D. Provide any software or firmware revisions which are released by the DDC system manufacturer during the warranty period, at no additional cost to the Owner.

#### 1.11 POSTED OPERATING INSTRUCTIONS

- A. Provide DDC controller related as-built documents in protective binder or clear plastic display envelope for each control enclosure panel. These instructions shall include such items as as-built control diagrams and sequence of operation, simplified narrative instructions and materials necessary to aid in the operation of the equipment at the local control panels.

#### 1.12 SPECIAL TOOLS

- A. Deliver two sets of any special tools required for operation, adjustment, resetting or maintenance, not including PC laptop.

#### 1.13 PROTECTION OF PROPRIETARY INFORMATION

- A. All proprietary manuals and software that are subject to a non-disclosure agreement shall be submitted by the proprietary equipment manufacturer to the Owner for signed approval during the warranty period.

## PART 2 - PRODUCTS

### 2.1 DESCRIPTION OF THE BUILDING AUTOMATION SYSTEM (BAS)

- A. The building automation system (BAS) shall be fully integrated, distributed data processing system incorporating direct digital control (DDC) for the control and monitoring of heating, ventilating and air conditioning (HVAC) equipment and other related systems. Microprocessor based BAS field level DDC controllers shall be directly connected to HVAC equipment sensors and actuators. A data communication network shall allow data exchange between the BAS field level DDC controllers and the Building Network Supervisory Controller and the Tridium Niagara N4 supervisory server application software. The primary operator BAS interface point for each building shall be through web-browser connection to the server application software.
- B. Approved Manufacturer - System: Johnson Controls - Facility Explorer with FX Controllers.
- C. Approved Installers (Locations) as listed:
  - 1. Building Automated Systems & Services aka BASS (Sterling Heights, MI).

### 2.2 BAS / DDC DATA COMMUNICATIONS NETWORK

- A. Data communication network shall be provided to allow data exchange between the BAS field level DDC controllers and the Building Network Supervisory Controller.
- B. The BAS/DDC system-wide communication network shall consist of a primary peer-to-peer network, and at the Contractor's option, secondary sub-networks linked to the primary network. The primary network shall support peer-to-peer communications between primary network BAS field level DDC controllers. The Building Network Supervisory Controller shall be connected to the primary network. Secondary sub-networks when used shall interface with the primary network through the primary network BAS field level DDC controllers. At least one DDC controller connected to the primary peer-to-peer network shall be provided in each mechanical room, or as indicated on the drawings.
- C. Data communications media shall be twisted pair wires.
- D. The communications network shall allow shared point and control information between BAS field level DDC controllers. All required repeaters, hubs, active links, gateways, etc. and associated power supplies shall be provided as required to provide shared point and control information between BAS field level DDC controllers.
- E. Failure of any individual BAS field level DDC controller shall not cause the loss of communications between peer BAS field level DDC controllers.
- F. All data transmitted must be positively acknowledged as received or negatively acknowledged as not received. Negative acknowledgments shall cause a retransmission of the data. Network connected devices must send a "functioning" message each network cycle. Lack of a "functioning" message after successive retries shall constitute a device failure and shall be recognized as such by the network.

- G. Error recovery and communication initialization routines shall be resident in each network connected device

### 2.3 BAS BUILDING NETWORK SUPERVISORY CONTROLLER

- A. The Building Network Supervisory Controller shall provide the interface between the Owner's Ethernet and the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:
  - 1. Calendar functions
  - 2. Scheduling.
  - 3. Trending.
  - 4. Alarm monitoring and routing.
  - 5. Time synchronization.
  - 6. Integration of BACnet controller data.
  - 7. Network Management functions for all BACnet based devices.
- B. The Network Area Controller shall provide the following hardware and driver features as a minimum:
  - 1. One RS-232 port
  - 2. One RS-485 port with BACnet MS/TP Driver.
  - 3. Battery Backup
  - 4. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity).
  - 5. Where the option for expanded memory is available, it must be supplied.
- C. Provide BACnet driver(s) as required for system or equipment integration requirements for the project. Provide LON or MODBUS drivers for the BASE BID Tridium N4 system only if required for the existing installed systems.
- D. NSC shall have 25% additional spare node addresses for future expansion.
- E. Provide 5 year service agreement per supervisory controller for updating firmware/software as available by manufacturer. Labor for updating the controllers shall be included.
- F. Manufacturer:
  - 1. Vykon Niagara 4 JACE-8000 series or Johnson Controls FX-80, sized appropriately per building to handle the required quantity of connected controllers and devices.

### 2.4 BAS DDC ADVANCED UNITARY CONTROLLER

- A. The controller platform shall be designed specifically to control HVAC equipment identified on the drawings. The controller platform shall provide options and advanced system functions, programmable and configurable using the described Network Supervisory Controller (NSC) platform, that allow standard and customizable control solutions required in executing the "Sequence of Operation" as identified on the drawings. Minimum requirements:

1. The controller shall be fully programmable with full functionality on NSC platform:
  - a. Support downloads to the controller from NSC platform
  - b. Support uploads from the controller to NSC platform.
  - c. Support simulation/debug mode of the controller
  - d. Maintain native GUI
  - e. Native function-block programming within the NCS platform environment
2. The controller shall be capable of either integrating with other devices or stand-alone operation.
3. The controller shall have sufficient on-board inputs and outputs to support the following applications:
  - a. Analog outputs (AO) shall be capable of being configured to support 0-10 V, 2-10 V, or 4-20 mA devices.
  - b. Analog outputs (AO) shall be capable of being configured to support 0-10 V, 2-10 V, or 4-20 mA devices.
  - c. Triac outputs shall be capable of switching 30 Volts at 500 mA.
  - d. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring. Input and Output wiring terminals shall be designated with color coded labels.
  - e. Universal inputs shall be capable of being configured as binary inputs, resistive inputs, voltage inputs (0-10 VDC), or current inputs (4-20 mA).
4. The controller shall provide “continuous” automated loop tuning with an Adaptive Integral Algorithm Control Loop.
5. The controller platform shall have standard HVAC application programs that are modifiable to support both the traditional and specialized “sequence of operations”.

B. Manufacturer, models:

1. Johnson Controls, FX-PCG and PCA programmable controllers.

C. Where applicable: Associated room temperature sensors for the controllers:

1. Space temperature monitoring using 1K ohm platinum resistance detector (RTD) to cover 50°F to 90°F temperature range with +/- 1°F accuracy.
2. Where indicated on control details: Provide space temperature with exposed LCD temperature reading, exposed temperature setpoint adjustment and exposed occupancy override switch to allow an occupant to reset the space to occupied control during the unoccupied cycle for a predetermined time period. Manufacturer, model for respective controller: Johnson Controls, NS-BTB7003.
3. Where indicated on control details: Provide blank space temperature sensor. Manufacturer, model for respective controller: Johnson Controls, NS-BTN7003.

## 2.5 BAS DDC AIR TERMINAL UNIT CONTROLLERS

- A. The controller platform shall be designed specifically for room-level VAV or CAV terminal unit control - pressure-independent air flow control, temperature, complex CO2 (where indicated). The controller platform shall provide options and advanced system functions, programmable and configurable using the described Network Supervisory Controller (NSC) platform, that allow standard and customizable control solutions required in executing the “Sequence of Operation”.



- B. The controller shall be fully programmable with full functionality on any Niagara AX brand platform:
  - 1. Support downloads to the controller from NSC platform.
  - 2. Support uploads from the controller to NSC platform.
  - 3. Support simulation debug mode of the controller.
  - 4. Maintain native GUI.
  - 5. Native function-block programming within the NSC platform environment.
- C. The controller shall be capable of either integrating with other devices or stand-alone room level control operation.
- D. The controller shall have sufficient on-board inputs and outputs to support the application as follows:
  - 1. Analog outputs (AO) shall be capable of being configured to support 0-10 V, 2-10 V or 4-20 mA devices.
  - 2. Triac outputs shall be capable of switching 30 Volts at 500 mA.
  - 3. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring. Input and Output wiring terminals shall be designated with color coded labels.
  - 4. Universal inputs shall be capable of being configured as binary inputs, resistive inputs, voltage inputs (0-10 VDC), or current inputs (4-20mA).
- E. The controller shall provide continuous automated loop tuning with an Adaptive Integral Algorithm Control Loop.
- F. The controller shall have a loop execution response time of 1 second.
- G. Provide electronic type air terminal unit damper operators compatible with the controller and the air terminal units provided.
- H. Each controller shall have an internal differential pressure transducer capable of utilizing the total and static pressure signals from the air terminal unit's velocity sensor. Velocity sensor shall be furnished by air terminal unit manufacturer.
- I. TC contractor shall provide 24 VAC power requirements including transformers.
- J. If coordinated with mechanical contractor. Controllers and damper operators shall be furnished to the air terminal unit manufacturer for factory mounting by the air terminal unit manufacturer; otherwise, controls shall be field installed.
- K. Manufacturer, models:
  - 1. Johnson Controls, FX-PCV programmable controllers.
- L. Associated room temperature sensors for the controllers:
  - 1. Space temperature monitoring using 1K ohm platinum resistance detector (RTD) to cover 50 to 90°F temperature range with +/- 1°F accuracy.
  - 2. For conference room and individual office applications: Provide space temperature with exposed LCD temperature reading, exposed temperature setpoint adjustment and exposed occupancy override switch to allow an occupant to reset the space to occupied control during the unoccupied cycle for a predetermined time period. Manufacturer, model for respective controller: Johnson Controls, NS-BTB7003.

3. For open office area, corridors, restrooms and other public spaces: Provide blank space temperature sensor. Manufacturer, model for respective controller: Johnson Controls, NS-BTN7003.

## 2.6 BAS CONTROLLER SERVICE TOOL SOFTWARE

- A. Provide BAS controller service tool software that can be provided on Owner provided PC laptops for knowledgeable Owner personnel to carry and plug into communication interface ports provided at BAS Controllers. The software shall allow the operator to write or modify DDC programs, add/delete points and/or systems, modify setpoints, parameters, schedules, read point values, etc. Provide appropriate data cables.
- B. Provide licensing for 5 installations if not unlimited

## 2.7 DDC UNIT VENTILATOR CONTROLLERS

- A. Microprocessor based controllers capable of stand-alone operation for independent unit ventilators. Controllers shall be networked together and connected to the building's BAS/DDC network.
- B. Each controller shall have electronic outputs to electronically operate damper and control valve operators. Provide electronic type damper and control valve operators compatible with the controller provided.
- C. TC contractor shall provide 24 VAC power requirements including transformers.
- D. If coordinated with mechanical contractor. Controllers, damper and valve operators shall be furnished to unit ventilator manufacturer for factory mounting by the unit ventilator manufacturer; otherwise, controls shall be field installed.
- E. Room temperature sensors for the DDC unit ventilator controllers:
  1. Sensing Element: Thermistor or resistance temperature detector (RTD) type. Accuracy shall be +/- 0.5 degrees F over the range of 55 degrees F to 95 degrees F, including calibration error, repeatability, hysteresis, and yearly drift.
  2. Cover: with tamper-proof fasteners.
  3. Provide with exposed setpoint adjustment dial and exposed temperature reading.
  4. Provide with exposed override switch to allow an occupant to reset the space to occupied control during the unoccupied cycle for a predetermined time period.

## 2.8 DDC INPUT/OUTPUT SENSORS

- A. Air Static/Differential Pressure Transmitters:
  1. Variable capacitance type with ranges not exceeding 150 percent of maximum expected input. Transmitter shall have zero and span adjustments.
  2. Safe overpressure rating shall be minimum 5 times the range.
  3. Temperature compensated with thermal error of not greater than 0.04 percent of full scale in temperature range of 40 to 100 deg F.

4. Accuracy: +/- 0.5% of full scale including calibration error, repeatability, hysteresis, and yearly drift.
5. Manufacturers:
  - a. Dwyer.
  - b. Setra.
  - c. Modus.
  - d. Air Monitor.

B. Carbon Dioxide Sensors:

1. Carbon dioxide sensing cell shall consist of a nondispersive infrared carbon dioxide gas cell that uses a pulsed source and has no free air optical path. Output shall be linearized 4-20 mA with the 24 VDC input. In addition, the unit shall be capable of providing SPDT switching of an external low voltage circuit at an adjustable setpoint. The unit shall be specifically designed for the wall or duct application specified. Return air aspiration boxes shall be designed by and approved by the manufacturer. Unit shall have single point setpoint and span adjustment. The unit shall have no moving parts.
2. Power for the sensor shall be extended from a transformer or adaptor installed adjacent to the DDC controller enclosure panel, and shall be run parallel to the 4-20 mA signal cable.
3. Minimum sensing range shall be 0-2,000ppm.
4. Overall Accuracy shall be 3% of full scale including calibration error, repeatability, hysteresis and yearly drift.
5. Minimum calibration interval shall be 5 years.
6. Contractor shall provide all necessary equipment and test gas for calibration and shall calibrate all CO<sub>2</sub> sensors in accordance with the manufacturer's recommendations.
7. Manufacturer:
  - a. Honeywell.
  - b. Schneider Electric Controls.
  - c. Johnson Controls.
  - d. Siemens.
  - e. TelAire.
  - f. Vaisala.
  - g. Veris.

C. Current Switches:

1. Split-core or donut type transformer for monitoring AC current, with digital output signal. Current switches used on motor side of variable frequency drives shall have low frequency detection capability.
2. Current switches with digital output shall have adjustable trip settings. Provide field adjustment of current switches to trip at approximately 90% of normal motor operating amperage.
3. Manufacturers:
  - a. Johnson Controls.
  - b. NK Technologies.
  - c. Senva.
  - d. Setra.
  - e. Veris Industries.

D. Differential Pressure Transmitters (Commercial Version):

1. Transmitters used for measuring differential pressure only:
  - a. Each differential pressure transmitter shall be selected and calibrated for operations between 0 and 200% of the normal differential pressure. The calibration point shall be rounded upward to the nearest 10 inches of water column (for spans less than 200" W.C.) or to the nearest 5 psi for larger spans. Calibration date shall be included on an embossed tag attached to each transmitter.
  - b. The accuracy, including linearity, hysteresis and repeatability, of the transmitter for measuring differential pressure shall be better than 2% of the span stated above throughout a 4:1 turndown.
  - c. The transmitter shall not be damaged by pressures of up to 500 psig on either side of the transmitter and all wetted parts shall be essentially inert in the presence of up to a 40% concentration of ethylene or propylene glycol in water.
  - d. Provide a drain valve for each side of the pressure chamber. Furnish and install mounting brackets appropriate for the installation location.
  - e. Span and zero shall be individually adjustable.
  - f. With LCD Display.
  - g. Manufacturers:
    - 1) Dwyer.
    - 2) Setra.
    - 3) Veris Industries.
2. Three Valve Manifold:
  - a. Provide a three-valve manifold for each transmitter. The manifold shall not be damaged by pressures of up to 500 psig and all wetted parts shall be essentially inert in the presence of up to a 40% concentration of ethylene glycol in water.
  - b. The manifold shall be designed for direct mounting on the transmitter it serves and utilize quarter-turn valves to provide zeroing, blocking and normal service modes.

E. Humidity Sensors:

1. Elements: Thin film capacitive type or bulk polymer resistance type with linear output, accurate within 3 2% RH including calibration error, repeatability and hysteresis throughout the range of 0-99% RH at 77 deg F. Factory calibrate for maximum accuracy at mid-range of normal operating humidity. All humidity sensors shall be resistant to chlorine and other cleaning agents.
2. Room Sensors: With locking cover matching space temperature sensors used.
3. Duct Sensors: With duct probe and mounting plate.
4. Manufacturers:
  - a. Specified BAS product where available.
  - b. Rotronic.
  - c. GE Industrial, Sensing (formerly General Eastern).
  - d. Vaisala.

F. Outside Air Temperature/Humidity Combination Transmitters:

1. Dual transmitters housed in a single hinged enclosure with integral probes configured for exterior wall mount application with PVC sun shield. Unit shall provide separate 4-20 mA signals for temperature and humidity measurement.

2. Temperature sensor shall be 1000 OHM thin film platinum resistance temperature detector with matching 4-20 mA transmitter having independent zero and span adjustments. Accuracy shall be  $\pm 0.5$  degrees F with a range of -25 degrees F to 125 degrees F.
3. Humidity sensor shall be washable thin film type with matching 4-20 mA transmitter having independent zero and span adjustments and linear output over a span of 0-100% RH. Accuracy shall be  $\pm 2.5\%$  RH including calibration error, repeatability and hysteresis throughout the range of 0-95% RH at 77 deg F.
4. Manufacturer:
  - a. GE Industrial, Sensing (formerly General Eastern)
  - b. Veris.

G. Temperature Sensors:

1. Resistance temperature detectors (RTD) with platinum, nickel or balco element. Accuracy shall be  $\pm 0.5$  deg F over the entire range. Range shall be as indicated below, or as appropriate to the application.
2. Single point duct mounted sensors shall have 18" rigid probe and calibrated span of 20 - 120°F.
3. Averaging duct mounted sensors shall have 25' long averaging element and calibrated span of 20 - 120°F.
4. Liquid immersion sensors shall have welded stainless steel thermowells for ferrous pipe and brass thermowells for copper pipe. Length of sensor and thermowell shall be selected based on the diameter of the pipe to provide accurate, reliable and homogeneous sensing of the liquid temperature. Thermowell pressure rating shall meet or exceed the system minimum pressure rating. Sensors for chilled water application shall have calibrated span of 20 - 120°F. Sensors for hot water applications shall have calibrated span of 40 - 240°F
5. Room sensors shall have locking cover and a minimum span of 40 - 90°F.
6. Outside air sensors shall have watertight inlet fitting and shall be shielded from direct rays of sun and wind.
7. Manufacturers:
  - a. Specified BAS product where available.
  - b. TCS.
  - c. Minco.
  - d. ACI.
  - e. MAMAC.

2.9 CONTROL AND INSTRUMENTATION TUBING

A. Copper Tubing: ASTM B280 or ASTM B75, seamless, hard drawn or annealed.

1. Fittings: ANSI/ASME B16.22, wrought copper.
2. Joints: ANSI/ASTM B32, 95-5 tin antimony.

B. Copper Tubing: ASTM B280 or ASTM B75, seamless, hard drawn or annealed.

1. Fittings: UL approved rod or forged brass rated to 200 psig at 100 degrees F.
2. Joints: Ball Sleeve compression type.

- C. Polyethylene Tubing: Black, UL 1820 flame and smoke retardant where exposed in an air plenum, virgin polyethylene, conforming to modified ASTM D1693 test. All non-metallic tubing shall be minimum 1/4" O.D.; micro-sleeve is not acceptable.
  - 1. Fittings: UL approved rod or forged brass rated to 200 psig at 100 degrees F.
  - 2. Joints: Compression or barbed type.

## 2.10 CONTROL VALVES AND VALVE OPERATORS

- A. Pressure dependent Characterized Ball Valves (2-way & 3-way):
  - 1. Up to 2 inches: Bronze body with screwed ends, stainless steel or chrome plated brass ball, characterizing disc, stainless steel or brass stem, and resilient reinforced Teflon seats.
  - 2. Manufacturers:
    - a. Belimo.
- B. Globe Valves (2-way & 3-way):
  - 1. Up to 2 inches: Bronze body, bronze trim, rising stem, renewable composition disc, single seated, screwed ends with backseating capability, repackable under pressure.
  - 2. Over 2 inches: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and disc, repackable under pressure.
  - 3. Valve stem packing shall be tetrafluorethylene, spring loaded and self-adjusting. Packless construction is acceptable.
  - 4. Manufacturers:
    - a. Belimo.
- C. Electric Operators:
  - 1. Operators shall be electronic type to accept signals from direct digital controller or modulating thermostat for proportional control.
  - 2. Valves shall spring return to normal position as indicated. Terminal unit tempering coil control valve operators are not required to be spring return.
  - 3. Select with sufficient shut-off power for system pressure and highest operating torque, and torque requirements of valves which may stick because of infrequent use.
  - 4. Select to provide smooth proportioning control under operating conditions normal to the system.
- D. Hydronic Systems:
  - 1. Valve minimum pressure rating shall meet or exceed the system minimum pressure rating as noted for each system in Division 20 Section "Valves," and in Division 23 Section "Hydronic Piping."
  - 2. Valve minimum temperature ratings shall be 250 deg F.
  - 3. For globe valves: Replaceable plugs and seats of stainless steel or brass, selected for maximum lift under application conditions.
  - 4. Two way and three way valves shall have equal percentage characteristics. Size two way valve operators to close valves against pump shut off head.
  - 5. Pressure independent control valves shall be used for 2-way applications unless otherwise indicated. Select to achieve scheduled flow rate of the associated heat transfer device. If the scheduled flow rate is too high to

achieve with one valve, provide multiple valves sized at flow divided equally of the scheduled flow rate and control all valves in unison - coordinate control valve quantity and the need for parallel piping of control valves with mechanical contractor.

6. Pressure Drop for pressure dependent characterized ball and globe valves: As scheduled on the drawings. If not scheduled, primary HVAC equipment control valves shall be selected for a pressure drop close as possible to 11.5 feet of head (5 psig), +/- 10%. If not scheduled, terminal equipment control valves shall be selected for a pressure drop close as possible to 11.5 feet of head (5psig) with allowable minimum of 2.3 feet of head (1 psig) where flow rates are minimal and valve Cv choices are limited. TC Contractor shall use valves from listed manufacturers that meet the pressure drop requirements.

## 2.11 DAMPERS - AUTOMATED

- A. Performance: Test in accordance with AMCA 500.
- B. Frames: Galvanized steel, minimum 16 gauge, minimum 2 inches in width, welded or riveted with corner reinforcement for 12 gage structural equivalence.
- C. Blades: Galvanized steel, minimum 14 gauge, maximum blade size 8 inches wide, 60 inches long, attached to minimum 1/2 inch shafts. Dampers which are required to have a static pressure rating over 4 inch W.G. shall have minimum 3/4 inch solid shafts.
- D. Blade Seals: Synthetic elastomeric or Neoprene, mechanically attached, field replaceable.
- E. Jackshafts (where required): Minimum 1/2 inch galvanized steel.
- F. Jamb Seals: Stainless steel.
- G. Bearings: Oil impregnated sintered bronze or lubricant free, solid stainless steel. Provide thrust washers at bearings for all dampers which are to be mounted with blades in the vertical position.
- H. Linkages: Accessible for maintenance. Linkages may be located in airstream. Linkages located in damper frame shall be external to the duct, accessible for maintenance. Linkages located in the airstream shall be zinc-plated.
- I. Leakage: Less than 8 CFM per square foot based on 4 inches W.G. pressure differential.
- J. Static Pressure Rating: As scheduled on the drawings, or if not scheduled, minimum 4" W.G.
- K. Maximum Velocity: As scheduled on the drawings, or design for maximum velocity to be encountered in location where installed.
- L. Temperature Limits: -40 to 200 deg F.
- M. Manufacturers:
  1. American Warming & Ventilating.
  2. Arrow United Industries.

3. Greenheck.
4. Honeywell.
5. Johnson Controls.
6. Louvers & Dampers, Inc.
7. Ruskin.
8. Tamco.
9. Vent Products.

2.12 DAMPERS, INSULATED OUTDOOR AIR / RELIEF AIR / EXHAUST AIR - AUTOMATED

- A. Performance: AMCA certified for Air Performance and Air Leakage.
- B. Frames: Extruded aluminum, .080-inch thickness minimum, 4 inches deep minimum, thermally broken, and insulated with polystyrene or polyurethane foam insulation.
- C. Blades: Extruded aluminum, internally insulated, and thermally broken. Maximum blade size 8 inches wide, 60 inches long.
- D. Shafts: Minimum 7/16 inch hexagonal or square corrosion resistant zinc plated steel.
- E. Blade Seals: Extruded EPDM, silicone, or synthetic elastomeric, mechanically attached.
- F. Jamb Seals: Silicone, or synthetic elastomeric, mechanically attached.
- G. Bearings: Dual bearing assembly of durable synthetic polymer resulting in no metal-to-metal contact. Provide thrust washers at bearings for all dampers which are to be mounted with blades in the vertical position.
- H. Linkage: Linkage shall be installed in the frame side and shall be constructed of aluminum and/or corrosion resistant zinc plated steel.
- I. Leakage: Less than 3 CFM per square foot at 1 inch W.G. pressure differential at minus 40 deg F.
- J. Static Pressure Rating: As scheduled on the drawings, or if not scheduled, minimum 4 inches W.G.
- K. Maximum Velocity: As scheduled on the drawings, or design for maximum velocity to be encountered in location where installed.
- L. Temperature Limits: Minus 40 to 155 deg F.
- M. Manufacturers:
  1. Greenheck ICD-45.
  2. Ruskin CDTI-50BF.
  3. Tamco Series 9000 BF

2.13 DAMPER OPERATORS - ELECTRIC

- A. Electric damper motor shall be 24 or 120 volt two-position or modulating as required with spring return type and sized to operate the damper with sufficient reserve



power for smooth operation from full close to full open and tight shut-off. Damper motor shall have "O ring" gaskets for weatherproof operation.

- B. Number: Sufficient to achieve unrestricted movement throughout damper range. Provide sufficient number of operators such that one operator does not operate more than the maximum square footage of damper area as recommended in standard catalog of manufacturer.
- C. Manufacturers:
  - 1. Belimo.
  - 2. Delta Control Products.
  - 3. Johnson Controls.

#### 2.14 DIFFERENTIAL PRESSURE SWITCHES

- A. Shall provide electrical switching action upon a sensed pressure differential increase between two points. Sensitivity shall be suitable for the application. Setpoint shall be adjustable over the full range of the device. Switching action shall open or close two independent single pole double throw switches. Electrical switch rating shall be 10 amps at 120 VAC.
- B. Pressure rating of switch and connecting tubing:
  - 1. Fan - Rated for 12 inches W.C.

#### 2.15 EMERGENCY POWER-OFF (EPO) PUSH-BUTTON

- A. ADA compliant, push-button switch with clear cover to prevent inadvertent closure. Push-to-activate push-button, and providing two SPDT contacts rated 10 Amps at 120 VAC.
- B. Manufacturers:
  - 1. Safety Technology International - model SS-2212PO
  - 2. Alarm Controls Corporation - model ADC-100.

#### 2.16 INDICATING GAUGES - DUCT STATIC PRESSURE

- A. 4" diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, scale as indicated on drawings or as appropriate for application, suitable for surface or flush mounting. Accuracy 3 2 % of full scale.
- B. Where indicated on drawings, gauge shall incorporate high and low pressure switches. Switches shall be front adjustable over the full range of the gauge with pointers and with adjustable deadband to 1% of full scale. Separate electrical contacts shall close upon reaching the high or low pressure setpoints.
- C. Manufacturer:
  - 1. Dwyer "Magnehelic" or "Photohelic."

2.17 LIMIT SWITCHES

- A. Oil tight type with operator as required providing required function. Limit switches used on dampers should be set at approximately 75% of full stroke.
- B. Manufacturers:
  - 1. Allen-Bradley.
  - 2. General Electric.
  - 3. Square D.
  - 4. Westinghouse.
  - 5. Micro-switch.

2.18 LOCAL AND AUXILIARY CONTROL COMPONENT ENCLOSURE PANELS

- A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, pushbuttons and switches flush on cabinet panel face, or as detailed on drawings. Provide panel with locking door.
- B. ANSI/NEMA 250, general purpose utility enclosures with enameled finished face panel, or as indicated on the drawings.
- C. Panels shall be sized for a maximum fill of 50% capacity, and shall not be smaller than 24" X 24".

2.19 REFERENCE PROBE - DUCT STATIC PRESSURE

- A. Duct static pressure probe shall be capable of static pressure measurement with bi-directional flow in a duct, plenum or air handling unit. Probe shall have minimum 4" insertion depth, shall compensate for total pressure error, and shall provide an accurate, repeatable and stable static pressure value with a maximum flow of 4000 fpm.
- B. Probe shall be constructed of aluminum, with mounting flange suitable for round or flat duct surfaces. Probe shall have static pressure signal fitting.
- C. Manufacturers:
  - 1. MAMAC # A-520.
  - 2. Dwyer # A-305.
  - 3. Tek-Air # T-SPP 7100/7200.

2.20 REFERENCE PROBE - INDOOR STATIC PRESSURE

- A. Indoor pressure reference probe shall be a shielded static pressure sensor suitable for flush mounting in the ceiling, complete with multiple sensing ports, pressure impulse suppression chamber, airflow shielding, control tubing take-off fitting, and brush finish on exposed surface. Probe shall be capable of sensing the static pressure in the proximity of the sensor to within 1% of the actual pressure value while being subjected to a maximum airflow of 1000 fpm from a radial source.
- B. Manufacturers:

1. Air Monitor Corporation.
2. Tek-Air.

#### 2.21 REFERENCE PROBE - OUTDOOR STATIC PRESSURE

- A. Outdoor pressure reference probe shall be constructed of anodized aluminum, with control tubing take-off fitting, which shall be capable of sensing the outside ambient air pressure to within 2% of the actual value when subjected to radial wind velocities up to 80 miles per hour with approach angles up to 30 degrees to the horizontal.
- B. Manufacturers:
  1. Air Monitor Corporation.
  2. Tek-Air.

#### 2.22 AIRFLOW MEASURING PROBES - DUCT MOUNTED

- A. Duct airflow measuring probes shall contain multiple total and static pressure sensors located along the exterior surface of the probe, designed to compensate for non-axial or turbulent flow.
- B. Thermal Dispersion type technology may be used in-lieu of static pressure measurement.
- C. Probes shall be constructed of extruded aluminum. Probes shall be provided with mounting plate, gasket, and static and total pressure fittings. Probe and mounting hardware shall facilitate easy removal and reinstallation of the probes.
- D. The number of sensors on each probe, and the quantity of probes provided at each location, shall comply with ASHRAE standards for duct traversing. Multiple probes provided at a single location shall be interconnected external to the duct to produce an average signal.
- E. For each airflow measurement location, the measured velocity pressure shall have accuracy within 3 2% of the full scale throughout the velocity range of 300-4000 fpm.
- F. Each airflow measurement location shall be provided with an air volume gauge, dial and pointer type with diaphragm element. Black letters on white background, 4" diameter, with scale calibrated to permit direct reading of the airflow (in cfm) of the connected airflow measuring station. LCD readout with associated transmitter is acceptable.
- G. Manufacturers:
  1. Air Monitor Corporation.
  2. Ebtron.

#### 2.23 AIRFLOW MEASURING PROBES - FAN INLET

- A. Fan inlet airflow measuring probes shall contain multiple total and static pressure sensors located along the exterior surface of the probe, designed to compensate for non-axial or turbulent flow. Two probes shall be provided for each fan inlet opening.

- B. Thermal Dispersion type technology may be used in-lieu of static pressure measurement.
- C. Probes shall be constructed of extruded aluminum. Probes shall be provided with mounting bracket designed for attachment to fan inlet bell, and shall have static and total pressure fittings. Probe and mounting hardware shall facilitate easy removal and reinstallation of the probes.
- D. Fan inlet airflow measuring probes shall not induce a measurable pressure drop, nor shall the sound level within the system be amplified by its presence.
- E. For each fan, the measured airflow shall have accuracy within 3 3% of the actual flow throughout a fan operating range of 6 to 1 capacity turndown.
- F. Each airflow measurement location shall be provided with an air volume gauge, dial and pointer type with diaphragm element. Black letters on white background, 4" diameter, with scale calibrated to permit direct reading of the airflow (in cfm) of the connected airflow measuring station. LCD readout with associated transmitter is acceptable.
- G. Manufacturers:
  - 1. Air Monitor Corporation.
  - 2. Farr.
  - 3. Ultratech Industries, Inc.
  - 4. Brandt.
  - 5. Tek-Air Systems, Inc.
  - 6. Ramsey Ventures.
  - 7. Ebtron.

#### 2.24 AIRFLOW MEASURING PROBES - OUTSIDE AIRFLOW

- A. Duct airflow measuring probes shall be Thermal Dispersion type.
- B. Probes shall be constructed of extruded aluminum. Probes shall be provided with mounting plate, and gasket. Probe and mounting hardware shall facilitate easy removal and reinstallation of the probes.
- C. The number of sensors on each probe, and the quantity of probes provided at each location, shall comply with ASHRAE standards for duct traversing. Multiple probes provided at a single location shall be interconnected external to the duct to produce an average signal.
- D. For each airflow measurement location, the measured velocity pressure shall have accuracy within 3 2% of the full scale throughout the velocity range of 0-4000 fpm.
- E. Associated transmitter at each airflow measurement location shall be provided with LCD readout to indicate airflow (in CFM) of the connected airflow measuring station.
- F. Manufacturers / Model:
  - 1. Ebtron / Gold Series.
  - 2. Air Monitor Corporation / ELECTRA-flo.

2.25 AIRFLOW MEASURING STATIONS - DUCT MTD THERMAL DISPERSION (INCLUDING OA FLOW)

- A. Airflow measuring station with thermal dispersion type technology utilizing perimeter chamber with array of inlet ports to produce an overall average airflow rate shall be a preassembled unit including casing with connecting flanges, fabricated to the duct size.
- B. Airflow measuring station shall have a galvanized steel casing (or stainless steel if manufacturer's standard) and the entire assembly shall be fabricated to withstand the maximum pressures and velocities for the application.
- C. Probe type units shall be constructed of extruded aluminum and the number of sensors on each probe, and the quantity of probes provided at each location, shall comply with ASHRAE standards for duct traversing. Multiple probes shall be interconnected external to the duct to produce an average signal.
- D. Perimeter chamber type units shall direct air through the mass airflow sensing probe.
- E. For each airflow measurement location, the measured airflow shall have accuracy within 3 2% of the full scale throughout the velocity range of 0-4000 fpm.
- F. Associated transmitter at each airflow measurement location shall be provided with LCD readout to indicate airflow (in CFM) of the overall airflow measuring station.
- G. Manufacturer:
  - 1. NJK Precision Air Flow Measurement Products.

2.26 THERMOSTATS - ELECTRONIC & ELECTRIC

- A. Line Voltage Thermostats: Maximum dead band of 2 degrees F concealed temperature adjustment, locking cover, rated for load, single-pole or two-pole as required. Provide with integral manual On/Off/Auto selector switch where indicated. Provide with locking covers when located in public areas.
- B. Room Thermostat Accessories:
  - 1. Thermostat Covers: Manufacturers standard with finish as selected by Architect.
  - 2. Insulating Bases: Provide one inch insulating base for thermostats located on exterior walls.
  - 3. Adjusting Key: As required for device.
- C. Electric Low Limit Duct Thermostat (freezestat): Snap acting which trips if temperature sensed across any 12 inches of bulb length is equal to or below setpoint, fixed 5 deg F differential, range 30 deg F to 60 deg F, requiring minimum 20 feet length of bulb. Manual-reset unless indicated on drawings to be auto-reset type. Provide one thermostat for every 20 sq ft of coil surface. Switch shall be UL listed and rated for 10 amps at 120 VAC. Provide additional switch or contacts for connection to monitoring system.
- D. Strap-on Aquastat: UL listed, with a suitable removable spring clip attaching aquastat to pipe and a snap-acting SPDT switch.

- E. Manufacturers:
  - 1. Honeywell.
  - 2. Schneider Electric Controls.
  - 3. Johnson Controls.
  - 4. Siemens.

## 2.27 ELECTRICAL REQUIREMENTS FOR CONTROLS WORK

- A. Electrical accessories such as relays, switches, contactors and control transformers shall meet the requirements of the Division 26 Specifications of respective project.
- B. Electrical wiring and conduit shall meet the requirements of the Division 26 Specifications.
- C. All control wiring in mechanical rooms and any other exposed areas shall be run in conduit. Low voltage temperature control wiring in concealed accessible locations (i.e. above lay-in ceilings), as well as low voltage temperature control wiring within partitions, may be run using plenum rated cable, neatly tie-wrapped and fastened to the building structure (not to ceiling or ceiling support wires).
- D. Conduits carrying control wiring shall be sized for a maximum fill of 40% of capacity.
- E. Where raceway is required, two separate raceway systems shall be provided; one for A.C. wiring and the other for D.C. wiring.
- F. Data transmission cabling and equipment grounding procedures shall meet the latest FCC guidelines for electromagnetic field generation.
- G. All control wiring sizes and types shall meet or exceed the equipment manufacturer's recommendations.

## PART 3 - EXECUTION

### 3.1 INSTALLATION - CONTROL SYSTEMS

- A. Install in accordance with manufacturer's instructions.
- B. Check and verify location of temperature sensors, thermostats and other exposed control sensors with plans and room details before installation. Locate room temperature sensors and thermostats 48 inches above floor unless noted otherwise.
- C. The location of all control-related items to be mounted on the exterior of the building must be approved by the Architect prior to installation. Indicate proposed locations on the shop drawings.
- D. Caulk both sides of damper frames to duct walls to prevent leakage between damper frame and duct.
- E. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. Sensors used for closed loop control must be connected to the same DDC controller as the associated output signal.

- F. Provide conduit and electrical wiring where required.
- G. All wiring in altered and unaltered areas shall be run concealed. "Wiremold" in finished areas shall be allowed when wiring cannot be run concealed in walls or partitions. Minimize "wiremold" routing.
- H. Splicing of DDC sensor cabling at junction boxes shall not be acceptable.
- I. All equipment which has moving parts and is remotely started by the control system shall be provided with warning labels no less than 2 inches in height, and in bright warning color, stating that the equipment is remotely started by automatic controls. Such labels shall be posted clearly in the area of any moving parts, such as belts, fans, pumps, etc.
- J. Coil and conceal excess capillary on remote element instruments.
- K. Locate all control components and accessories such that they are easily accessible for adjustment, service and replacement.
- L. Locate, size and support sensing elements in airstreams so that they properly sense the representative condition. Controlling, transmitting and indicating elements shall be located to sense the average condition. Safety elements shall be located to sense the extreme condition.
- M. Locate and size sensing elements in liquid lines so that they are in moving liquid and not in stagnant or turbulent locations. Wells shall not obstruct the flow of the liquid being measured. Pipes one inch and smaller shall be increased at least one pipe size at the point of insertion.
- N. Locate pressure sensing taps in liquid lines in straight runs of pipe with at least 10 pipe diameters of straight pipe both upstream and downstream of pressure tap. Provide a shut-off cock in sensing line at each pressure tap.
- O. Install pressure sensing elements in ducts and casings with clean, sharp taps to accurately read true static pressure, avoiding velocity influence and turbulence.
- P. Locate, support and install all control components and accessories so that they will not be subject to vibration, excessive temperatures, dirt, moisture or other harmful conditions beyond their rated limitations.
- Q. Where insulation is penetrated due to the installation of sensing elements or tubing, reseal the openings air and vapor tight. Provide brackets for devices to be located on insulated surfaces so as to clear the finished surface of the insulation and to avoid puncturing the vapor seal.
- R. Provide all necessary relays, switches, linkages, control devices, accessories and connections as required for a complete and operational control system as specified herein and shown.
- S. All electric valve and damper operators shall be capable of moving from full closed to full open, or vice versa, within 120 seconds.

### 3.2 IDENTIFICATION AND MARKING

- A. All sensors, relays, switches, etc. shall be marked with the same identification number as used on the as-built shop drawings. Use Brother P-touch label maker or similar with black text on clear or white super adhesive tape. If label applied in wet environment, spray label with clear enamel for waterproofing.
- B. Wire shall be color coded according to functional use. Identify color coding format on record drawings.
- C. Identify each wire as to ID number at each controller termination, field device termination or on the field device.
- D. All control panels and auxiliary enclosures shall be supplied with engraved phenolic nameplate permanently attached identifying it as control panel number, system served, area served, fed from lighting panel number, circuit number, etc.
- E. Temperature control conduit and junction box covers shall be painted a standard color to signify that it is used for temperature controls. All junction box covers shall be painted the standard color and the conduit shall be painted with a standard color mark (approximately 6 inches long) every 36" to 48", and on both sides of all penetrations. Coordinate color with the Architect.

### 3.3 GRAPHIC DISPLAY GENERATION

- A. Provide the following graphic displays as a minimum at the operator interface, arranged in logical penetration paths:
  - 1. Overall campus layout which shows all of the buildings on the Owner's campus.
  - 2. Individual building layout or isometric for each building connected to the system.
  - 3. Floor plans for each floor within each building, with display of present values of space conditions sensed by connected space sensors, display of the name of the air handler associated with each space sensor, display of the room number in which the sensor is located and color coding to indicate whether the sensed space condition is within the acceptable range, is too high, or is too low. TC Contractor shall confirm Owner desired room names prior to graphics generation which may differ from the room names indicated on construction documents.
  - 4. Schematic diagram for each HVAC system. Each system schematic display shall include at least the following:
    - a. Schematic arrangement of ductwork, fans, dampers, coils, valves, piping, pumps, equipment etc.
    - b. System name.
    - c. Area served.
    - d. Present value or status of all inputs, along with present setpoint.
    - e. Present percent open for each damper, valve, etc. based on commanded position.
    - f. Reset schedule parameters for all points, where applicable.
    - g. Present occupancy mode.
    - h. Present economizer mode, where applicable.
    - i. Present outside air temperature.
    - j. Associated space conditions and setpoints, where applicable.
    - k. Status of application programs (e.g., warm-up, night cycle, duty cycle, etc.).



- I. Color coding to indicate normal and abnormal values, alarms, etc.
  5. Manual override capability for each on/off or open/closed controlled digital output (for fans, pumps, 2-position dampers and valves, etc.) and each modulating analog output (for dampers, valves, VFD speed modulation type points, etc) shall be provided. Graphic display of output point auto or manual override status shall be provided.
  6. Sequence of operation in written (text) format for each HVAC system.
  7. Overall BAS system schematic.
  8. System management graphic for each network device and/or DDC controller.
- 3.4 OWNER INSTRUCTION AND TRAINING
- A. Provide a minimum of forty (40) hours of combined on-site and classroom instruction and training to the Owner on the operation of the control systems for the initial installation.
  - B. Instruction and training shall be performed by a competent Contractor representative familiar with the control systems operation, maintenance and calibration.
  - C. Training shall take place after check, test, start-up of temperature controls system at a time mutually agreed upon by the Owner and Contractor.
  - D. Provide 5 sets of computer training & tutorial CD's describing workstation operation and functions.
  - E. Provide 5 sets of literature pertaining to the operation and maintenance of the DDC system components provided.
- 3.5 CALIBRATION AND START-UP
- A. After installation and connection of control components, test, adjust and re-adjust as required all control components in terms of function, design, systems balance and performance. Make systems ready for environmental equipment acceptance tests.
  - B. After environmental equipment has been accepted and after the systems have operated in normal service for two weeks, check the adjustment on control components and recalibrate where required. Components not in calibration shall be recalibrated to function as required, or shall be replaced. Control devices, linkages, and other control components shall be calibrated and adjusted for stable and accurate operation in accordance with the design intent and to obtain optimum performance from the equipment controlled. Cause every device to automatically operate as intended to ensure its proper functionality.
- 3.6 ACCEPTANCE PROCEDURE
- A. Upon successful completion of start-up and recalibration as indicated in this section, the Architect shall be requested in writing to inspect the satisfactory operation of the control systems.
  - B. Demonstrate operation of all control systems, including each individual component, to the Owner and Architect.

- C. After correcting all items appearing on the punch list, make a second written request to the Owner and Architect for inspection and approval.
- D. After all items on the punch list are corrected and formal approval of the control systems is provided by the Architect, the Contractor shall indicate to the Owner in writing the commencement of the warranty period.

END OF SECTION 230933

SECTION 231123 - FUEL GAS PIPING

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."

1.2 SUMMARY

- A. This Section includes facility fuel gas piping.

### 1.3 DEFINITIONS

- A. Gas Main: Utility's natural gas piping.
- B. Gas Distribution: Piping from gas main to individual service-meter assemblies.
- C. Service-Meter Assembly: Piping, valves, service regulator, service meter, and specialties.
- D. Point of Delivery: Piping outlet from service-meter assembly.
- E. Fuel Gas Piping: Piping that conveys fuel gas from point of delivery to fuel gas utilization devices.

### 1.4 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
  - 1. Piping and Valves: Performance requirements are scheduled on the Drawings.
  - 2. Exception: Fuel Gas Piping Installed within Ceilings Used as Plenums: 150 psig.

### 1.5 SYSTEMS DESCRIPTIONS

- A. Fuel gas piping system materials are scheduled on the Drawing.

### 1.6 SUBMITTALS

- A. Product Data: For the following:
  - 1. Specialty valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
  - 2. Pressure regulators. Include pressure rating, capacity, and settings of selected models.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For natural gas specialties and accessories to include in operation and maintenance manuals.
  - 1. Lubricated Plug Valves: Installation, operation, lubrication, and leak testing procedures.

### 1.7 QUALITY ASSURANCE

- A. NFPA Standard: Comply with NFPA 54, "National Fuel Gas Code."

### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and legally dispose of liquids from drips in existing gas piping. Handle cautiously to avoid spillage and ignition. Notify fuel gas

supplier. Handle flammable liquids used by Installer with proper precautions and do not leave on premises from end of one day to beginning of next day.

- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

## 1.9 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Gas System Pressure: Not more than 5.0 psig.
- C. Design values of fuel gas supplied for these systems are as follows:
  - 1. Nominal Heating Value: 1000 Btu/cu. ft.
  - 2. Nominal Specific Gravity: 0.6.

## 1.10 COORDINATION

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Architect's written permission.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 BLACK STEEL PIPE AND FITTINGS

- A. Black Steel Pipe: ASTM A 53/A 53M or ASTM A 106; Type E or S; Grade B; Schedule 40. Wall thickness of wrought-steel pipe shall comply with ASME B36.10M.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
2. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
3. Steel Welding Fittings: ASME B16.9, wrought steel or ASME B16.11, forged steel.
4. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
5. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Class 125.
6. Joint Compound and Tape: Suitable for natural gas.
7. Steel Flanges and Flanged Fittings: ASME B16.5.
8. Gasket Material: Thickness, material, and type suitable for natural gas.

## 2.3 PIPING SPECIALTIES

### A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

### B. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

## 2.4 JOINING MATERIALS

### A. Refer to Division 20 Section "Basic Mechanical Materials and Methods."

## 2.5 SPECIALTY VALVES

### A. Valves, NPS 3 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

### B. Valves, NPS 4: Threaded ends according to ASME B1.20.1 for pipe threads; or flanged ends according to ASME B16.5 for steel flanges.

### C. Valves, NPS 6 and Larger: Flanged ends according to ASME B16.5 for steel flanges.

### D. Natural Gas Valves, NPS 3 and Smaller: Use the following:

1. Ball Valves: Bronze or brass body with AGA or CSA stamp, UL listed or FM approved for service, with chrome-plated brass ball and lever handle; 125-psig minimum pressure rating.
  - a. Manufacturers:
    - 1) Apollo Valve; Conbraco Industries, Inc.
    - 2) Jomar International Ltd.
    - 3) Legend Valve and Fitting, Inc.

- 4) NIBCO INC.
  - 5) Watts Water Technologies, Inc.; Watts Regulator Co.
- b. Tamperproof Feature: Include design for locking.
2. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
    - a. Manufacturers:
      - 1) Flowserve Nordstrom.
      - 2) Homestead Valve; a division of Olson Technologies, Inc.
      - 3) R&M Energy Systems, a Unit of Robbins & Myers, Inc.; Resun.
    - b. Body: Cast iron, complying with ASTM A 126, Class B.
    - c. Plug: Bronze or nickel-plated cast iron.
    - d. Seat: Coated with thermoplastic.
    - e. Stem Seal: Compatible with natural gas.
    - f. Operator: Square head or lug type with tamperproof feature where indicated.
    - g. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.
    - h. Pressure Class: 125 psig.
- E. Natural Gas Valves, NPS 6 and Larger: Use any of the following:
1. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
    - a. Manufacturers:
      - 1) Flowserve Nordstrom.
      - 2) Homestead Valve; a division of Olson Technologies, Inc.
      - 3) R&M Energy Systems, a Unit of Robbins & Myers, Inc.; Resun.
    - b. Body: Cast iron, complying with ASTM A 126, Class B.
    - c. Plug: Bronze or nickel-plated cast iron.
    - d. Seat: Coated with thermoplastic.
    - e. Stem Seal: Compatible with natural gas.
    - f. Operator: Square head or lug type with tamperproof feature where indicated.
    - g. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.
    - h. Pressure Class: 125 psig.
  2. Class 150, Full-Port, Carbon-Steel Ball Valves:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Apollo Valve; Conbraco Industries, Inc.; 88A-200-UL Series.
      - 2) Metso Automation; Jamesbury Valves.
    - b. UL listed.
    - c. Split-body construction.
    - d. Chrome-plated carbon steel ball.
    - e. Reinforced PTFE seats.
    - f. Lever actuation.

## 2.6 SERVICE METERS

- A. Turbine Meters: Axial-flow type suitable for fuel gas service. Comply with construction criteria for axial-flow, gas turbine meters in ASME MFC-4M. Include metal body, corrosion-resistant internal components, and flow registered in cubic feet. Equip meter with a pulse transmitter having an output of 1 pulse per 100 cfh.
1. Manufacturers:
    - a. American Meter Company.
    - b. IMAC.
    - c. Sensus Metering Systems Inc.
  2. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
  3. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges.

## 2.7 PRESSURE REGULATORS

- A. Description: Single stage and suitable for fuel gas service. Include steel jacket and corrosion-resistant components, elevation compensator, and atmospheric vent.
1. Manufacturers:
    - a. Line Pressure Regulators:
      - 1) Elster Gas North America; Elster American Meter.
      - 2) Fisher Controls International, Inc.; Division of Emerson Process Management.
      - 3) Itron Gas.
    - b. Appliance Pressure Regulators:
      - 1) Elster Gas North America; Elster American Meter.
      - 2) Elster Gas North America; Elster Canadian Meter.
      - 3) Fisher Controls International, Inc.; Division of Emerson Process Management.
      - 4) Maxitrol Company; 325 Series.
  2. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
  3. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges.
  4. Service Pressure Regulators: ANSI Z21.80. Include 100-psig- minimum inlet pressure rating.
  5. Line Pressure Regulators: ANSI Z21.80/GCA 6.22 or ANSI B109.4/CGA 6.18, with inlet pressure rating as scheduled on the Drawings.
    - a. Regulators for Generator Sets: Direct operated, fast acting type.
  6. Appliance Pressure Regulators: ANSI Z21.18. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
- B. Pressure Regulator Vents: Factory- or field-installed, corrosion-resistant screen in opening if not connected to vent piping.



### PART 3 - EXECUTION

#### 3.1 EXCAVATION

- A. Refer to Division 31 Section "Earthwork" for excavating, trenching, and backfilling.

#### 3.2 EXAMINATION

- A. Examine roughing-in for fuel gas piping system to verify actual locations of piping connections before equipment installation.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.3 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to NFPA 54 and the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54 and the International Fuel Gas Code requirements for prevention of accidental ignition.

#### 3.4 PIPING SYSTEM INSTALLATION

- A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Basic piping installation requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- D. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels, unless indicated to be exposed to view.
- E. Concealed Locations:
  - 1. Above Inaccessible Ceiling Locations: Gas piping with welded joints may be installed in inaccessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves or unions above inaccessible ceilings.
  - 2. Above Accessible Ceiling Locations: Gas piping with welded joints may be installed in accessible ceiling spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves or unions above ceilings used as plenums.

3. In Floor Channels: Gas piping may be installed in floor channels, subject to approval of authorities having jurisdiction. Channels must have cover and be open to space above cover for ventilation.
  4. Underground Beneath Building: Gas piping may be installed in protective conduit in accordance with Chapter "Gas Piping Installations" in the International Fuel Gas Code.
  5. In Partitions: Do not install concealed piping in solid partitions, unless installed in a chase or casing.
    - a. Exception: Piping passing through partitions or walls.
  6. In Walls: Gas piping with welded joints and protective wrapping specified in Part 2 "Protective Coating" Article may be installed in masonry walls, subject to approval of authorities having jurisdiction.
  7. Prohibited Locations: Do not install gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
- F. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.
1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.
- G. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.
- H. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- I. Connect branch piping from top or side of horizontal piping.
- J. Install pressure gage upstream and downstream from each line pressure regulator. Pressure gages are specified in Division 20 Section "Meters and Gages."
- K. Locate valves for easy access.
- L. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
- M. Install flanges when connecting to valves, specialties, and equipment having NPS 2-1/2 and larger connections.
- N. Install gas valve or plug valve and strainer upstream from each line pressure regulator or appliance pressure regulator.
- O. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.

- P. Install containment conduits for gas piping below slabs, within building, in gastight conduits extending minimum of 4 inches outside building, and vented to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end. Prepare and paint outside of conduits with coal-tar, epoxy-polyamide paint according to SSPC-Paint 16.

### 3.5 JOINT CONSTRUCTION

- A. Basic piping joint construction is specified in Division 20 Section "Basic Mechanical Materials and Methods."
- B. Use materials suitable for fuel gas.
- C. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

### 3.6 HANGER AND SUPPORT INSTALLATION

- A. Pipe hanger and support and equipment support materials and installation requirements are specified in Division 20 Section "Hangers and Supports."
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  - 4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
  - 5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.
- C. Support vertical steel pipe at each floor and at spacing not greater than 15 feet.

### 3.7 CONNECTIONS

- A. Drawings indicate general arrangement of fuel gas piping, fittings, and specialties.
- B. Install piping adjacent to appliances to allow service and maintenance.
- C. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches of each appliance. Install union downstream from valve.
- D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.

### 3.8 SERVICE-METER ASSEMBLY INSTALLATION

- A. Service meter assembly will be installed by the fuel gas utility company.

- B. Coordinate with gas company for service meter requirements.
- C. Install gas valve or plug valve and strainer upstream from each service pressure regulator.
- D. Install service pressure regulators with vent outlet turned down and with corrosion-resistant-metal insect screen.
- E. Install pressure gage upstream and downstream from each service pressure regulator. Pressure gages are specified in Division 20 Section "Meters and Gages."
- F. Install service meters downstream from service pressure regulators.
  - 1. Service meters with connections larger than NPS 1 supported from piping or set on concrete bases.

### 3.9 SERVICE ENTRANCE PIPING

- A. Extend fuel gas piping and connect to fuel gas distribution for service entrance to building.
  - 1. Exterior fuel gas distribution system piping, service pressure regulator, and service meter will be provided by gas utility.
  - 2. Refer to Article entitled "Codes, Permits and Fees" in Division 20 Section "Mechanical General Requirements" for additional requirements.
- B. Install dielectric fitting downstream from and adjacent to each service meter unless meter is supported from service-meter bar with integral dielectric fitting. Install shutoff valve downstream from and adjacent to dielectric fitting. Dielectric fittings are specified in Division 20 Section "Basic Mechanical Materials and Methods."

### 3.10 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each service meter, pressure regulator, and specialty valve.
  - 1. Text: In addition to name of identified unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
  - 2. Nameplates, pipe identification, and signs are specified in Division 20 Section "Mechanical Identification."

### 3.11 PAINTING

- A. Use materials and procedures in Division 09 painting Sections.
- B. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.12 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Test, inspect, and purge natural gas according to NFPA 54 and the International Fuel Gas Code and authorities having jurisdiction.
- C. Additional Testing: Subject welded fuel gas piping installed within ceiling spaces used as plenums to test pressure of 150 psig for a minimum of 2 hours.
- D. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.13 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, and maintain lubricated plug valves.

END OF SECTION 231123

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Division 20 Section "Mechanical General Requirements."
- B. Division 20 Section "Basic Mechanical Materials and Methods" for general piping materials and installation requirements.
- C. Division 20 Section "Hangers and Supports" for pipe supports, product descriptions, and installation requirements. Hanger and support spacing is specified in this Section.
- D. Division 20 Section "Pipe Flexible Connectors, Expansion Fittings and Loops."
- E. Division 20 Section "Meters and Gages" for thermometers, flow meters, flow measuring devices, and pressure gages.
- F. Division 20 Section "Mechanical Identification" for labeling and identifying hydronic piping.
- G. Division 23 Section "General-Duty Valves for HVAC" for general-duty gate, globe, ball, butterfly, and check valves.
- H. Division 23 Section "Temperature Controls" for temperature-control valves and sensors.
- I. Division 23 Section "Piping Systems Flushing and Chemical Cleaning."
- J. Division 23 Section "HVAC Water Treatment."

1.2 SUBMITTALS

- A. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.

- B. Air control devices.
- C. Hydronic specialties.

## PART 2 - PRODUCTS

### 2.1 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
- C. DWV Copper Tubing: ASTM B 306, Type DWV.
- D. Wrought-Copper Socket Fittings: ASME B16.22.
- E. Wrought-Copper Unions: ASME B16.22.

### 2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe. Include ends matching joining method.
- B. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body, with ball-and-socket, metal-to-metal, bronze seating surface and female threaded ends.
- C. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- D. Cast-Iron Flanges: ASME B16.1, Class 125.
- E. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125.
- F. Fittings: ASTM A234 ANSI B16.9, steel butt weld to match pipe wall thickness, Class 300.
- G. Flanges: Class 300 forged steel welding neck to match pipe wall thickness and valve flanges, ANSI B16.5. Orifice plate flanges shall be raised face welding neck type with ring joint gaskets and flange taps. Coordinate orifice plate flanges with orifice plate flow elements.
- H. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 80, seamless steel pipe. Include ends matching joining method.
- I. Screwed Couplings: Extra heavy tapered threaded black carbon steel.
- J. Screwed Unions: 300 pound SWP female screwed malleable iron with ground joint and brass to iron seat.
- K. Screwed Fittings: 300 pound SWP banded malleable iron screwed, ASTM A 197 and ANSI B16.3.

## 2.3 SPECIALTY VALVES

- A. Balance Valves NPS 6 and Larger: Lug type butterfly valves with aluminum bronze disc, AISI 300 Series stainless steel stem, resilient replaceable seat for service at not less than 250 deg F and memory stops. Refer to Division 23 Section "General-Duty Valves for HVAC" for additional requirements.
1. Provide lubricated enclosed screw or worm gear operator with handwheel for sizes 6 inches and larger.
  2. Pressure rating shall meet or exceed system minimum pressure rating.
- B. Flow Measuring: Use Flow Measuring Devices as specified in Division 20 Section "Meters and Gages."
- C. Balance Valves for Sizes Less than NPS 6 Combination balance valve and flow measuring device as specified in this Section.
- D. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Griswold Controls.
  2. Hydronic Components, Inc. (HCi).
  3. IMI Flow Design; IMI Hydronic Engineering Inc.
  4. Nexus Valve.
  5. PRO Hydronic Specialties, LLC.
- E. Manufacturers: Subject to compliance with requirements, use products by one of the following:
1. Tour & Andersson; TA Hydronics Series available through Victaulic Company of America.
  2. Tyco Fire & Building Products, Grinnell Mechanical Products (formerly marketed by Mepco).
    - a. Body: Brass or bronze, ball or plug type with calibrated orifice or venturi.
    - b. Ball: Plated brass, or stainless steel.
    - c. Plug: Resin.
    - d. Seat: PTFE.
    - e. End Connections: Threaded or socket.
    - f. Pressure Gage Connections: Integral seals for portable differential pressure meter.
    - g. Handle Style: Lever, with memory stop to retain set position.
    - h. WOG Rating: Minimum 400 psig.
    - i. Maximum Operating Temperature: 250 deg F.
    - j. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  3. Griswold Controls.
    - a. Hydronic Components, Inc. (HCi).
    - b. IMI Flow Design; IMI Hydronic Engineering Inc.
    - c. Nexus Valve.
    - d. PRO Hydronic Specialties, LLC.
  4. Manufacturers: Subject to compliance with requirements, use products by one of the following:



- a. Tour & Andersson; TA Hydronics Series available through Victaulic Company of America.
  - b. Tyco Fire & Building Products, Grinnell Mechanical Products (formerly marketed by Mepco).
    - 1) Body: Cast-iron or steel body, ball, plug, butterfly, or globe pattern with calibrated orifice or venturi.
    - 2) Stem Seals: EPDM O-rings.
    - 3) Disc: Glass and carbon-filled PTFE.
    - 4) Seat: PTFE.
    - 5) End Connections: Flanged or grooved.
    - 6) Pressure Gage Connections: Integral seals for portable differential pressure meter.
    - 7) Handle Style: Lever, with memory stop to retain set position.
    - 8) WOG Rating: Minimum 200 psig.
    - 9) Maximum Operating Temperature: 225 deg F.
    - 10) Manufacturers: Subject to compliance with requirements, provide products by one of the following:
5. Griswold Controls.
- a. Hydronic Components, Inc. (HCi).
  - b. IMI Flow Design; IMI Hydronic Engineering Inc.
  - c. Nexus Valve; Coil Pak.
  - d. PRO Hydronic Specialties, LLC.
6. Manufacturers: Subject to compliance with requirements, use products by one of the following:
- a. Tour & Andersson; TA Hydronics Series available through Victaulic Company of America.
  - b. Tyco Fire & Building Products, Grinnell Mechanical Products (formerly marketed by Mepco).
7. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Amtrol, Inc.
  - b. Armstrong Pumps, Inc.
  - c. Bell & Gossett; Xylem Inc.
  - d. Conbraco Industries, Inc.
  - e. Spence Engineering Company, Inc.
  - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - 1) Body: Bronze or brass.
    - 2) Disc: Glass and carbon-filled PTFE.
    - 3) Seat: Brass.
    - 4) Stem Seals: EPDM O-rings.
    - 5) Diaphragm: EPT.
    - 6) Low inlet-pressure check valve.
    - 7) Valve Seat and Stem: Noncorrosive.
    - 8) Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.
  - g. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Amtrol, Inc.
  - 2) Anderson Greenwood & Co.; Kunkle Valve Division.
  - 3) Armstrong Pumps, Inc.
  - 4) Bell & Gossett; Xylem Inc.; Models 790 and 1170.
  - 5) Conbraco Industries, Inc.; Apollo Valve.
  - 6) Spence Engineering Company, Inc.
  - 7) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - a) Body: Bronze or brass.
    - b) Disc: Glass and carbon-filled PTFE.
    - c) Seat: EPDM.
    - d) Stem Seals: EPDM O-rings.
    - e) Diaphragm: EPDM.
    - f) Wetted, Internal Work Parts: Brass and rubber.
    - g) Valve Seat and Stem: Noncorrosive.
    - h) Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.
8. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Amtrol, Inc.
  - b. Anderson Greenwood & Co.; Kunkle Valve Division.
  - c. Armstrong Pumps, Inc.
  - d. Bell & Gossett; Xylem Inc.; 3301 and 4100.
  - e. Conbraco Industries, Inc.; Apollo Valve.
  - f. Spence Engineering Company, Inc.
  - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - 1) Body: Cast iron.
    - 2) Disc: Glass and carbon-filled PTFE.
    - 3) Seat: EPDM.
    - 4) Stem Seals: EPDM O-rings.
    - 5) Diaphragm: EPDM.
    - 6) Wetted, Internal Work Parts: Brass and rubber.
    - 7) Valve Seat and Stem: Noncorrosive.
    - 8) Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

## 2.4 AIR CONTROL DEVICES

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Amtrol, Inc.
  - b. Armstrong Pumps, Inc.
  - c. Bell & Gossett; Xylem Inc.
  - d. Spirotherm, Inc.
  - e. Taco, Inc.
2. Body: Bronze or cast iron.
3. Internal Parts: Nonferrous.

4. Operator: Noncorrosive metal float.
5. Inlet Connection: NPS 1/2.
6. Discharge Connection: NPS 1/4.
7. Maximum Operating Pressure: 150 psig.
8. Maximum Operating Temperature: 240 deg F.

## 2.5 HYDRONIC PIPING STRAINERS

1. Keckley.
2. Metraflex.
3. Mueller Steam Specialty.
4. Nibco, Inc.
5. Spence.
6. Sure Flow Equipment Inc.
7. Watts Water Technologies, Inc.
8. Yarway.
9. Anvil International, Inc.; Gruvlok Manufacturing (for grooved piping).
10. Tyco Fire & Building Products, Grinnell Mechanical Products (for grooved piping)
11. Victaulic Company; (for grooved piping).
12. CWP: 200 psig minimum, unless otherwise indicated.
13. SWP: 125 psig minimum, unless otherwise indicated.
14. Body: Bronze for NPS 2 and smaller.
15. End Connections: Threaded or soldered.
16. Strainer Screen: Stainless steel, 40-mesh unless otherwise noted or scheduled.
17. Drain:
  - a. Pipe plug for sizes NPS 2 and smaller.
  - b. Factory-installed, hose-end drain valve for sizes NPS 2-1/2 and larger.

## PART 3 - EXECUTION

### 3.1 HANGERS AND SUPPORTS

- A. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
- B. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
- C. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
- D. Spring hangers to support vertical runs.
- E. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
  1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
  2. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
  3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
  6. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
  7. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.

8. NPS 6: Maximum span, 17 feet; minimum rod size, 1/2 inch.
9. NPS 8: Maximum span, 19 feet; minimum rod size, 5/8 inch.
10. NPS 10: Maximum span, 20 feet; minimum rod size, 3/4 inch.
11. NPS 12: Maximum span, 23 feet; minimum rod size, 7/8 inch.
12. NPS 14: Maximum span, 25 feet; minimum rod size, 1 inch.
13. NPS 16: Maximum span, 27 feet; minimum rod size, 1 inch.
14. NPS 18: Maximum span, 28 feet; minimum rod size, 1-1/4 inches.
15. NPS 20: Maximum span, 30 feet; minimum rod size, 1-1/4 inches.
16. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
17. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
18. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
19. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
20. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
21. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
22. NPS 4 to NPS 5: Maximum span, 10 feet minimum rod size, 1/2-inch.
23. NPS 6: Maximum span, 10 feet minimum rod size, 5/8-inch.
24. NPS 8: Maximum span, 10 feet minimum rod size, 3/4-inch.

### 3.2 FIELD QUALITY CONTROL

- A. Leave joints, including welds, uninsulated and exposed for examination during test.
- B. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
- C. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
- D. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
- E. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- F. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
- G. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
- H. Isolate expansion tanks and determine that hydronic system is full of water.
- I. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
- J. After hydrostatic test pressure has been applied for at least 2 hours, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

- K. Prepare written report of testing.
- L. Open manual valves fully.
- M. Inspect pumps for proper rotation.
- N. Remove disposal fine-mesh strainers in pump suction diffusers.
- O. Set makeup pressure-reducing valves for required system pressure.
- P. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
- Q. Set temperature controls so all coils are calling for full flow.
- R. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
- S. Verify lubrication of motors and bearings.

END OF SECTION 232113

SECTION 232123 - HYDRONIC PUMPS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."

1.2 DEFINITIONS

- A. Buna-N: Nitrile rubber.
- B. EPT: Ethylene propylene terpolymer.

1.3 SUBMITTALS

- A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.
- B. Shop Drawings: Show pump layout and connections. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Operation and Maintenance Data: For all pumps and accessories to include in Operation and Maintenance manuals.

#### 1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hydronic pumps through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.

C. UL Compliance: Comply with UL 778 for motor-operated water pumps.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

B. Store pumps in dry location.

C. Retain protective covers for flanges and protective coatings during storage.

D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.

E. Comply with pump manufacturer's written rigging instructions.

#### 1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

### PART 2 - PRODUCTS

#### 2.1 GENERAL PUMP REQUIREMENTS

A. Pump Units: Factory assembled and tested.

B. Motors: Comply with requirements in Division 20 Section "Motors".

C. Selection:

1. Base non-overloading characteristics for pumps upon nameplate horsepower, at any point on performance curve.

2. Shaft first critical speed shall not be less than 25 percent greater than operating speed.
3. Maximum impeller diameter shall not be greater than 90 percent of “cut water” diameter for a given casing and no smaller than the smallest published diameter for casing. Do not base acceptable maximum diameter calculation on percentage of impeller diameter range for a given casing.
4. Pump speed shall be limited to 1800 RPM except as scheduled.
5. Select at the point of maximum efficiency for a given impeller-casing combination. Deviations shall be within 3 percent of maximum efficiency on the increasing capacity side of the maximum efficiency point and 7 percent on the decreasing capacity side of the maximum efficiency point.
6. Select pump at a point no greater than 85 percent of end of curve flow.
7. Maximum pump suction velocity:
  - a. In-line: 12 fps.
  - b. End suction: 13 fps.

## 2.2 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.3 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS (SMALL)

- A. Manufacturers:
  1. Armstrong Pumps Inc.
  2. Bell & Gossett; Xylem Inc.; Series PL.
  3. Grundfos Pumps Corporation.
  4. Taco, Inc.
- B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; and designed for installation with pump and motor shafts mounted horizontally.
  1. Pump Construction: Bronze fitted.
    - a. Casing: Radially split, cast iron, with threaded companion-flange connections.
    - b. Impeller: Glass-reinforced corrosion-resistant material; keyed to shaft.
    - c. Shaft: High-strength alloy steel.
    - d. Seal: Mechanical, carbon/silicon carbide seal.
    - e. Bearings: Permanently oil-lubricated type.
  2. Motor-Single speed, with oil-lubricated bearings, unless otherwise indicated; and directly mounted to pump casing. Comply with requirements in Division 20 Section “Motors.”
- C. Capacities and Characteristics: Refer to Schedule on Drawings.



## 2.4 SMALL CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

### A. Manufacturers:

1. Armstrong Pumps Inc.
2. Bell & Gossett; Xylem Inc.; Series e-90.
3. Grundfos Pumps Corporation.
4. Taco, Inc.

### B. Description: Factory-assembled and tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically. Rate pump for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.

### C. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, and companion-flange connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
3. Pump Shaft: Steel with copper-alloy shaft sleeve, or stainless steel.
4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N seal for all glycol systems and all water systems 225 deg F and below; EPT seals for water systems above 225 deg F. Include water slinger on shaft between motor and seal.

### D. Motor: Single speed, with permanently or grease lubricated ball bearings, unless otherwise indicated; and rigidly mounted to pump casing. Comply with requirements in Division 20 Section "Motors."

## 2.5 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

### A. Manufacturers:

1. Armstrong Pumps Inc.; Series 4360 and 4380.
2. Bell & Gossett; Xylem Inc.; Series e-80.
3. Grundfos Pumps Corporation.
4. Taco, Inc.; Series 1900 Series.

### B. Description: Factory-assembled and tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically. Rate pump for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.

### C. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, and companion-flange connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
3. Pump Shaft: Steel with copper-alloy shaft sleeve, or stainless steel.
4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N seal for all glycol systems and all water

systems 225 deg F and below; EPT seals for water systems above 225 deg F.  
Include water slinger on shaft between motor and seal.

- D. Motor: Single speed, with permanently or grease lubricated ball bearings, unless otherwise indicated; and rigidly mounted to pump casing. Comply with requirements in Division 20 Section "Motors"
- E. Capacities and Characteristics: Refer to Schedule on Drawings.

## 2.6 PUMP SPECIALTY FITTINGS

- A. Suction Diffuser: Angle pattern, minimum 175-psig pressure rating, cast-iron body and end cap for NPT or flanged connections or ductile iron body and end cap for grooved connections, pump-inlet fitting; with bronze startup and bronze or stainless-steel permanent strainers; bronze or stainless-steel straightening vanes; drain plug; and integral locating boss for field-fabricated support.
  - 1. Manufacturers:
    - a. Armstrong Pumps, Inc.
    - b. Bell & Gossett; Xylem Inc.
    - c. Grundfos Pumps Corporation/PACO.
    - d. Mueller Steam Specialty Company.
    - e. Taco; Fabricated Products Division.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.
- C. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

- D. Support in-line centrifugal pumps greater than 1/2 HP independent of piping. Use continuous-thread hanger rods and hangers of sufficient size to support pump weight. Do not support pump from motor housing plate.
- E. Refer to Division 20 Section "Mechanical Vibration Controls" for vibration isolation devices.
- F. Refer to Division 20 Section "Hangers and Supports" for hanger and support materials.
- G. Set base-mounted pumps on concrete bases. Disconnect flexible coupling before setting. Do not reconnect flexible couplings until alignment procedure is complete.
  - 1. Support pump baseplate on rectangular stainless steel blocks and shims, or on wedges with small taper, at points near foundation bolts to provide a gap of 3/4 to 1-1/2 inches between pump base and foundation for grouting.
  - 2. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and suction and discharge flanges of pump to verify that they are level and plumb.
  - 3. Install pumps on inertia bases where required. Refer to Division 20 Section "Mechanical Vibration Controls" for vibration isolation devices.

### 3.3 ALIGNMENT

- A. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and piping connections have been made.
- B. Comply with pump and coupling manufacturers' written instructions.
- C. Adjust pump and motor shafts for angular and offset alignment by methods specified in HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation." Laser align to a tolerance of 0.0005 inches maximum.
- D. After alignment is correct, tighten foundation bolts evenly but not too firmly.
- E. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

### 3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- D. Install check valve and throttling valve on discharge side of pumps. Triple-duty valves are not allowed.
- E. Install Y-type strainer or suction diffuser and shutoff valve on suction side of pumps as indicated on drawings.

- F. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.
- G. Install pressure gages on pump suction and discharge or at integral pressure-gage tappings, or install single gage with multiple-input selector valve.
- H. Ground equipment according to Division 26 Section "Grounding and Bonding."
- I. Connect wiring according to Division 26 Section "Conductors and Cables."

### 3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service for each pump supplied. Written report of the start-up shall be provided to the Owner and Engineer upon completion of services.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Check piping connections for tightness.
  - 3. Clean strainers on suction piping.
  - 4. Perform the following startup checks for each pump before starting:
    - a. Verify bearing lubrication.
    - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    - c. Verify that pump is rotating in the correct direction.
  - 5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
  - 6. Start motor.
  - 7. Open discharge valve slowly.

### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps.

END OF SECTION 232123

SECTION 232213 - STEAM AND CONDENSATE PIPING

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods" for general piping materials and installation requirements.
  - 3. Division 20 Section "Hangers and Supports" for pipe supports, product descriptions, and installation requirements. Hanger and support spacing is specified in this Section.
  - 4. Division 20 Section "Meters and Gages" for thermometers, flow meters, and pressure and vacuum gages.

5. Division 20 Section "Mechanical Identification" for labeling and identifying steam and condensate piping.
6. Division 23 Section "General-Duty Valves for HVAC."
7. Division 23 Section "Temperature Controls" for temperature-control valves and sensors.

## 1.2 DEFINITIONS

- A. HP: High-pressure piping operating at more than 15 psig as required by ASME B31.1.
- B. LP: Low-pressure piping operating at 15 psig or less as required by ASME B31.9.
- C. LCD: Liquid crystal display.

## 1.3 SYSTEMS DESCRIPTIONS

- A. Steam and condensate piping system materials are scheduled on the Drawing.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  1. Pressure-reducing and safety valve.
  2. Safety relief valve connectors.
  3. Steam trap.
  4. In-line separator.
  5. Air vent and vacuum breaker.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Shop Drawings: Detail, minimum 1/4 inch equals 1 foot scale, flash tank assemblies and fabrication of pipe anchors, hangers, pipe, multiple pipes, alignment guides, and expansion joints and loops and their attachment to the building structure. Detail locations of anchors, alignment guides, and expansion joints and loops.

## 1.6 CLOSEOUT SUBMITTALS

- A. Field quality-control test reports.
- B. Operation and Maintenance Data: For valves, safety valves, pressure-reducing valves, steam traps, air vents, vacuum breakers, and meters to include in emergency, operation, and maintenance manuals.

## 1.7 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME B31.1, "Power Piping" and ASME B31.9, "Building Services Piping" for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp flash tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

## 1.8 COORDINATION

- A. Coordinate layout and installation of steam and condensate piping and suspension system components with other construction, including light fixtures, hydronic piping, fire-suppression-system components, and partition assemblies.
- B. Coordinate pipe sleeve installation for foundation wall penetrations.
- C. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 07 Sections.
- D. Coordinate pipe fitting pressure classes with products specified in related Sections.
- E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Sections.
- F. Coordinate installation of pipe sleeves for penetrations through exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 07 Section "Through-Penetration Firestop Systems" for fire and smoke wall and floor assemblies.

## PART 2 - PRODUCTS

### 2.1 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M or ASTM A 106, Type E or S, Grade A or B, and Schedule as indicated. Include ends matching joining method.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated.
- C. Malleable-Iron Threaded Fittings: ASME B16.3; Classes 150 and 300 as indicated.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150 and 300 as indicated.
- E. Cast-Iron Threaded Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250 as indicated; raised ground face, and bolt holes spot faced.
- F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- G. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
  - 1. Material Group: 1.1.
  - 2. End Connections: Weld neck.
  - 3. Facings: Raised face.
- H. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, black steel of same Type, Grade, and Schedule as pipe in which installed.

## 2.2 STAINLESS-STEEL PIPE AND FITTINGS

- A. Stainless-Steel Pipe: Schedule 40, ASTM A 312/A 312M, Grade TP316L, seamless or electric resistance welded pipe.
- B. Fittings: ASTM A 403/A 403M, Class S, seamless fittings matching pipe thickness and grade, for welded joints.
- C. Flanges: ASME B16.1, Classes 125 and 250, constructed of ASTM A 351, Type 316L stainless steel.

## 2.3 JOINING MATERIALS

- A. Comply with requirements specified in Division 20 Section "Basic Mechanical Materials and Methods."

## 2.4 VALVES

- A. General Duty Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC."

## 2.5 SPECIALTY VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim: Type 316 stainless-steel ball and stem, reinforced TFE seats, blow-out-proof stem, with adjustable stem packing, threaded ends; 150 psig SWP and 600-psig CWP ratings.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; by Conbraco Industries, Inc.; Series 77-140.
    - b. Crane Valve Group; Crane Valves.
    - c. Milwaukee Valve Company.
    - d. NIBCO INC.; Model T-585-70-66.
    - e. Watts Water Technologies, Inc.
- B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim: Type 316 stainless-steel ball and stem, reinforced composite seats and stuffing box ring, blow-out-proof stem, with adjustable stem packing, threaded ends; 250 psig SWP and 600-psig CWP ratings.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; by Conbraco Industries, Inc.; Series 77-140-64.
- C. Stainless Steel Ball Valves:
  - 1. General: MSS SP-72, with ASTM A-351, Type CF8M, stainless-steel body; ASTM A-351, Type CF8M vented stainless-steel ball; and ASTM A-276, Type 316 stainless-steel stem; and having flanged ends and blowout-proof stem.
  - 2. Class 150, Full-Port, Ferrous-Alloy Ball Valves: Split-body construction, carbon-filled TFE seats; 285 psig CWP rating.



- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Apollo Valves; by Conbraco Industries, Inc.
    - 2) Metso Automation; Jamesbury Valves.
    - 3) Milwaukee Valve Company.
    - 4) NIBCO INC.; Model F-515-CS-F-66.
- D. Stop-Check Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Powell, Wm. Co.
    - b. Velan Valve Corporation, USA.
  2. General: Size valve to properly function from minimum boiler flow (full turn-down) to full load/flow.
  3. Body and Bonnet: Malleable iron.
  4. End Connections: Flanged.
  5. Disc: Cylindrical with removable liner and machined seat.
  6. Stem: Brass alloy.
  7. Operator: Outside screw and yoke with cast-iron handwheel.
  8. Packing: Polytetrafluoroethylene-impregnated packing with two-piece packing gland assembly.
  9. Pressure Class: 250.
- E. Trap Test Valve: Ball valve as specified in this Section.
- F. Cast Steel Gate Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Valve Group; Crane Valves; Fig 47 XUF.
    - b. Velan Valve Corporation, USA; Fig. F0064C - 02TY.
    - c. Powell, Wm. Co.
  2. Cast carbon-steel gate valves shall be ASTM spec. A216 Gr. WCB Class 150 Flanged. Gate valves shall be OS & Y bolted bonnet design with stainless steel trim and equipped with graphite packing in the stuffing box. Gate valves shall have the flexible wedge and seal welded set rings with backseating capacity. Seating surfaces shall be 13 percent chrome to hard facing. Valves shall be hand wheel operated. Valves shall comply with ANSI B16.34 - Pressure Temperature Rating and also ANSI: B16.5, B16.10, B16.25 and API 600.
- G. Class 300, Cast Carbon Steel Globe Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Powell, Wm. Co.
    - b. Velan Valve Corporation, USA.
    - c. Vogt Valve; Flowserve Corporation.
  2. Description:

- a. Standard: BS1873.
- b. Service Temperature Rating: 850 deg F.
- c. Body Material: Precision machined WCB cast carbon steel with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: 13Cr stem, 13Cr faced disc, and CoCr alloy faced seats.
- f. Gasket: Spiral wound stainless steel/graphite.
- g. Packing Ring: Graphite.

## 2.6 SAFETY VALVES

### A. Bronze or Brass Safety Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Apollo Valves; Conbraco Industries, Inc.
  - b. Leslie Controls, Inc.; CIRCOR International, Inc.
  - c. Spence Engineering Company, Inc.; CIRCOR International, Inc.
  - d. Kunkle Valve; Emerson Automation Solutions.
  - e. Spirax Sarco, Inc.
2. Disc Material: Forged copper alloy.
3. End Connections: Threaded inlet and outlet.
4. Spring: Fully enclosed steel spring with adjustable pressure range and positive shutoff, factory set and sealed.
5. Pressure Class: 250.
6. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.

### B. Cast-Iron Safety Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Apollo Valves; Conbraco Industries, Inc.
  - b. Leslie Controls, Inc.; CIRCOR International, Inc.
  - c. Spence Engineering Company, Inc.; CIRCOR International, Inc.
  - d. Kunkle Valve; Emerson Automation Solutions.
  - e. Spirax Sarco, Inc.
2. Disc Material: Forged copper alloy with bronze nozzle.
3. End Connections: Raised-face flanged inlet and threaded or flanged outlet connections.
4. Spring: Fully enclosed cadmium-plated steel spring with adjustable pressure range and positive shutoff, factory set and sealed.
5. Pressure Class: 250.
6. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.

## 2.7 SAFETY RELIEF VALVE VENT CONNECTORS

- ### A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMERICAN BOA INC.; SRV Vent Connectors.
2. Hyspan Precision Products, Inc.; Series 3500SRV Safety Relief Valve Connectors.
3. Senior Flexonics, Inc.

B. Connector consists of:

1. External Housing: ASME A53 Grade B, standard weight pipe.
2. Bellows: Laminated or multi-ply, externally pressurized, and constructed of ASTM A240 Type 321 stainless steel.
3. Internal Liner: Full bore, and constructed of A53 Grade B standard weight pipe.
4. Drain Port and Plug: 3000 lb. forged steel welded outlet fitting.
5. Minimum Pressure Rating: 150 psig, unless otherwise indicated.
6. Design Temperature Rating: 500 deg F.
7. End Connections: Weld.

## 2.8 PRESSURE-REDUCING VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong International, Inc.
2. Hoffman Specialty; Xylem Inc.
3. Spence Engineering Company, Inc.; CIRCOR International, Inc.
4. Spirax Sarco, Inc.
5. Watson-McDaniel.

B. Size, Capacity, and Pressure Rating: Factory set for inlet and outlet pressures indicated. Refer to Schedule on Drawings.

C. Description: Pilot-actuated, diaphragm type, with adjustable pressure range and positive shutoff.

1. Body: Cast iron.
2. End Connections: Threaded connections for valves NPS 2 and smaller and flanged connections for valves NPS 2-1/2 and larger.
3. Trim: Hardened stainless steel.
4. Head and Seat: Replaceable, main head stem guide fitted with flushing and pressure-arresting device cover over pilot diaphragm.
5. Gaskets: Non-asbestos materials.

D. Accessories: Shall be by pressure reducing valve manufacturer.

1. Acoustic Plates: Designed for installation between ANSI 125/150 or 250/300 Class flanges and to reorient normal exit turbulence of the steam flow.
  - a. Maximum Operating Pressure: 250 psig.
  - b. Maximum Operating Temperature 650 deg F.
2. In-Line Noise Diffusers: Constructed of rolled and welded steel components welded in accordance with ASME Section IX procedures. Pressure drop through diffuser shall not exceed one percent of line pressure upstream of pressure reducing valve.
  - a. Maximum Operating Pressure: 320 psig.
  - b. Maximum Operating Temperature: 600 deg F.

3. Acoustic Silencers: Welded steel construction meeting ASME Section VIII Div. 1 with fiberglass insulation mat.
  - a. Maximum Operating Pressure: 300 psig.
  - b. Maximum Operating Temperature: 650 deg F.

## 2.9 STRAINERS

### A. Manufacturers:

1. Apollo Valves; Conbraco Industries, Inc.
2. Keckley Company.
3. Metraflex Company.
4. Mueller Steam Specialty; a Watts Brand.
5. NIBCO, Inc.
6. Sure Flow Equipment Inc.
7. Titan Flow Control, Inc.
8. Watts.
9. Yarway; Emerson Automation Solutions.

### B. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B cast iron, with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for strainers NPS 2 and smaller; flanged ends for strainers NPS 2-1/2 and larger.
3. Strainer Screen: Use any of the following:
  - a. Stainless-steel, 20-mesh.
  - b. 0.033-inch diameter perforated stainless-steel.
  - c. Stainless-steel, 20-mesh strainer and perforated stainless-steel basket with 50 percent free area.
4. Tapped blowoff plug.
5. CWP Rating: 250-psig working steam pressure.

## 2.10 STAINLESS STEEL STRAINERS

### A. Manufacturers:

1. Apollo Valves; Conbraco Industries, Inc.
2. Keckley Company.
3. Metraflex Company.
4. Mueller Steam Specialty; a Watts Brand.
5. NIBCO, Inc.
6. Sure Flow Equipment Inc.
7. Titan Flow Control, Inc.
8. Watts.
9. Yarway; Emerson Automation Solutions.

### B. Y-Pattern Strainers:

1. Body: ASTM A 351, Type 316 stainless steel, with bolted cover and bottom drain connection.

2. End Connections: Threaded ends for strainers NPS 2 and smaller; flanged ends for strainers NPS 2-1/2 and larger.
3. Strainer Screen: Use any of the following:
  - a. Stainless-steel, 20-mesh.
  - b. 0.033-inch diameter perforated stainless-steel.
  - c. Stainless-steel, 20-mesh strainer and perforated stainless-steel basket with 50 percent free area.
4. Tapped blowoff plug.
5. CWP Rating: 250-psig working steam pressure.

## 2.11 STEAM TRAPS

### A. Float and Thermostatic Traps:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. Hoffman Specialty; Xylem Inc.
  - c. Spirax Sarco, Inc.
  - d. Watson-McDaniel.
2. Body and Bolted Cap: ASTM A 126, cast iron.
3. End Connections: Threaded.
4. Float Mechanism: Replaceable, stainless steel.
5. Head and Seat: Hardened stainless steel.
6. Trap Type: Balanced pressure.
7. Thermostatic Bellows: Stainless steel or monel.
8. Thermostatic air vent capable of withstanding 45 deg F of superheat and resisting water hammer without sustaining damage.
9. Vacuum Breaker: Thermostatic with phosphor bronze bellows, and stainless steel cage, valve, and seat.
10. Maximum Operating Pressure: 125 psig.

### B. Inverted Bucket Traps:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. Hoffman Specialty; Xylem Inc.
  - c. Spirax Sarco, Inc.
  - d. Watson-McDaniel.
2. Body and Cap: Cast iron.
3. End Connections: Threaded.
4. Head and Seat: Stainless steel.
5. Valve Retainer, Lever, and Guide Pin Assembly: Stainless steel.
6. Bucket: Brass or stainless steel.
7. Strainer: Integral stainless-steel inlet strainer within the trap body.
8. Air Vent: Stainless-steel thermostatic vent.
9. Pressure Rating: 250 psig.

## 2.12 THERMOSTATIC AIR VENTS AND VACUUM BREAKERS

### A. Thermostatic Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. Hoffman Specialty; Xylem Inc.
  - c. Spirax Sarco, Inc.
  - d. Trane Company.
  - e. Watson-McDaniel.
2. Body: Cast iron, bronze, or stainless steel.
3. End Connections: Threaded.
4. Float, Valve, and Seat: Stainless steel.
5. Thermostatic Element: Phosphor bronze bellows in a stainless-steel cage.
6. Pressure Rating: 125 psig.
7. Maximum Temperature Rating: 350 deg F.

### B. Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Check-All Valve Mfg. Co.
  - b. Hoffman Specialty; Xylem Inc.
  - c. Johnson Corporation (The).
  - d. Spirax Sarco, Inc.
  - e. Watson-McDaniel.
2. Body: Cast iron, bronze, or stainless steel.
3. End Connections: Threaded.
4. Sealing Ball, Retainer, Spring, and Screen: Stainless steel.
5. O-ring Seal: EPR.
6. Pressure Rating: 125 psig.
7. Maximum Temperature Rating: 350 deg F.

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEM INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Use indicated piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- K. Install drains, consisting of a tee fitting, NPS 3/4 full port-ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- L. Install steam supply piping at a minimum uniform grade of 0.2 percent downward in direction of steam flow.
- M. Install condensate return piping at a minimum uniform grade of 0.4 percent downward in direction of condensate flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side down.
- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to top of main pipe.
- P. Install valves according to Division 23 Section "General-Duty Valves for HVAC."
- Q. Install shutoff duty valves at branch connections to steam supply mains, at steam supply connections to equipment, and at the outlet of steam traps.
- R. Install safety valves on pressure-reducing stations and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.
- S. Install in-line separators in accordance with manufacturer's instructions.
- T. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- U. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- V. Install strainers on supply side of control valves, pressure-reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 nipple and full port ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

- W. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 20 Section "Pipe Flexible Connectors, Expansion Fittings and Loops."
- X. Identify piping as specified in Division 20 Section "Mechanical Identification."
- Y. Install drip legs at low points and natural drainage points such as ends of mains, bottoms of risers, and ahead of pressure regulators, and control valves.
  - 1. On straight runs with no natural drainage points, install drip legs at intervals not exceeding 300 feet.
  - 2. Size drip legs same size as main. In steam mains NPS 6 and larger, drip leg size can be reduced, but to no less than NPS 4.

### 3.2 STEAM-TRAP APPLICATION

- A. Use float and thermostatic traps to drain condensate from equipment served by modulating steam control valves.
- B. Use inverted bucket traps to drain condensate from steam mains.
- C. Size steam traps to handle minimum of two times maximum condensate load of apparatus served (at operating pressure differential) unless apparatus manufacturer recommends greater capacity. Size end of main steam drips traps to handle a minimum of three times maximum condensate load at operating pressure differential.
- D. Traps used on steam mains and branches shall be minimum 3/4 inch size.

### 3.3 STEAM-TRAP INSTALLATION

- A. Install steam traps in accessible locations as close as possible to connected equipment.
- B. Install steam traps with unions or flanged connections at both ends.
- C. Install trap test valve with hose connection and cap at all steam traps. Utilize top test plug for inverted bucket traps.
- D. Provide minimum 12 inch long drip leg of same pipe sizes as apparatus return connection between apparatus and steam trap.
- E. Remove thermostatic elements from steam traps during temporary and trial usage, and until system has been operated and dirt pockets cleaned of sediment and scale.
- F. Install full-port ball valve, strainer, and union upstream from trap; install union, check valve, and full-port ball valve downstream from trap unless otherwise indicated.

### 3.4 PRESSURE-REDUCING VALVE INSTALLATION

- A. Install pressure-reducing valves in accessible location for maintenance and inspection.



- B. Install bypass piping around pressure-reducing valves, with globe valve equal in size to area of pressure-reducing valve seat ring, unless otherwise indicated.
- C. Install gate valves on both sides of pressure-reducing valves.
- D. Install unions or flanges on both sides of pressure-reducing valves having threaded- or flanged-end connections respectively.
- E. Install pressure gages on low-pressure side of pressure-reducing valves after the bypass connection according to Division 20 Section "Meters and Gages."
- F. Install strainers upstream for pressure-reducing valve.
- G. Install accessories downstream of pressure reducing valves in accordance with manufacturer's instructions.
- H. Install safety valve downstream from pressure-reducing valve station.

### 3.5 SAFETY VALVE INSTALLATION

- A. Install safety valves according to ASME B31.1, "Power Piping."
- B. Pipe safety-valve discharge without valves to atmosphere outside the building.
- C. Install drip-pan elbow fitting adjacent to safety valve and pipe drain connection to nearest floor drain.
- D. Install safety relief valve connector where indicated on the Drawings.
- E. Install exhaust head with drain to waste, on vents equal to or larger than NPS 2-1/2.

### 3.6 HANGERS AND SUPPORTS

- A. Install hangers and supports according to Division 20 Section "Hangers and Supports." Comply with requirements below for maximum spacing.
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
  - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
- C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/4: Maximum span, 9 feet; minimum rod size, 1/4 inch.
  - 2. NPS 1: Maximum span, 9 feet; minimum rod size, 1/4 inch.

3. NPS 1-1/2: Maximum span, 12 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 13 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 14 feet; minimum rod size, 3/8 inch.
6. NPS 3: Maximum span, 15 feet; minimum rod size, 3/8 inch.
7. NPS 4: Maximum span, 17 feet; minimum rod size, 1/2 inch.
8. NPS 6: Maximum span, 21 feet; minimum rod size, 1/2 inch.
9. NPS 8: Maximum span, 24 feet; minimum rod size, 5/8 inch.
10. NPS 10: Maximum span, 26 feet; minimum rod size, 3/4 inch.
11. NPS 12: Maximum span, 30 feet; minimum rod size, 7/8 inch.
12. NPS 14: Maximum span, 32 feet; minimum rod size, 1 inch.
13. NPS 16: Maximum span, 35 feet; minimum rod size, 1 inch.
14. NPS 18: Maximum span, 37 feet; minimum rod size, 1-1/4 inches.
15. NPS 20: Maximum span, 39 feet; minimum rod size, 1-1/4 inches.

- D. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

### 3.7 PIPE JOINT CONSTRUCTION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

### 3.8 TERMINAL EQUIPMENT CONNECTIONS

- A. Size for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install traps and control valves in accessible locations close to connected equipment.
- C. Install vacuum breakers downstream from control valve, close to coil inlet connection.
- D. Install a drip leg at coil outlet.

### 3.9 FIELD QUALITY CONTROL

- A. Prepare steam and condensate piping according to ASME B31.1, "Power Piping" and ASME B31.9, "Building Services Piping," and as follows:
1. Leave joints, including welds, uninsulated and exposed for examination during test.
  2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  3. Flush system with clean water. Clean strainers.
  4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

- B. Perform the following tests on steam and condensate piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
  2. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength.
  3. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
- C. Prepare written report of testing.

END OF SECTION 232213

SECTION 232510 - PIPING SYSTEMS FLUSHING AND CHEMICAL CLEANING

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 22 Section "Domestic Water Piping," for disinfection of potable water piping.
  - 4. Division 23 Section "Hydronic Piping."
  - 5. Division 23 Section "Water Treatment for Closed-Loop Hydronic Systems."

1.2 SUMMARY

- A. This Section includes chemical cleaning for the following piping systems:
  - 1. Heating hot water.
  - 2. Chilled water.
  - 3. Snow melting system.

1.3 DEFINITIONS

- A. Cleaning: Recirculating water containing chemical cleaning and passivation compounds.
- B. Flushing: Using approved water on a once through basis.

#### 1.4 SUBMITTALS

- A. Product Data:
  - 1. Proposed cleaning chemicals and quantities.
  - 2. Analyses and reports of all chemical items concerning safety and compliance with government regulations.
- B. Shop Drawings: Reduced scale plans indicating locations of velocity measurements.
- C. Field quality-control test reports.
- D. Other Informational Submittals:
  - 1. Proposed, step-by-step, chemical cleaning procedure.
  - 2. Circulation pump suction and discharge pressure at start and completion of chemical cleaning operations.

#### 1.5 QUALITY ASSURANCE

- A. Conduct safety meetings with Owner's Representative and personnel involved in the cleaning process.
- B. Assume responsibility for damage, necessary subsequent cleaning, flushing, and inspection of Work under the Contract which results from improper flushing and cleaning operations including failure to flush all dead-ends.

#### 1.6 COORDINATION

- A. Schedule flushing and chemical cleaning activities immediately after piping system pressure testing and immediately prior to piping system chemical treatment work to minimize internal oxidization or flash corrosion of piping systems.
- B. Coordinate chemical cleaning work with other work to avoid accidental chemical discharge, spillage, or spray out, and electrolytically originated system damage resulting from concurrent chemical cleaning and arc welding.
- C. Coordinate with work performed under other Sections to provide in-place temporary strainers, spool pieces, flushing hose connections, cross-over piping, and isolation and drain valves.
- D. Chillers shall not be cleaned with any chloride component.
- E. Boilers shall be flushed and cleaned to remove rust and oil deposits.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. System Cleaning Chemicals: Subject to compliance with requirements, provide products by one of the following:

1. PVS-Nolwood Chemicals, Inc.; PVS CHILL CLP Cleaner.
2. Nalco, an Ecolab Company.
3. Mitco Custom Water Treatment.
4. H-O-H Chemicals, Inc.
5. GE Power & Water; Water & Process Technologies.
6. Enerco Corporation.

## 2.2 MATERIALS

- A. Cleaning chemicals shall be as recommended by manufacturer and compatible with piping system components and connected equipment.
- B. Cleaning and passivation chemical shall consist of an inorganic phosphate, yellow metal corrosion inhibitor (Tolytriazole), dispersant, and oil emulsifier.
- C. Provide additional temporary and permanent piping, equipment, and materials required for chemical cleaning work.
- D. Use potable water for flushing and cleaning operations, unless directed otherwise by the Architect.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Prior to flushing and cleaning activities, drain the system of all water used for hydrostatic testing.
- B. Temporarily connect dead-end supply and return piping as necessary to result in recirculating system in which no lines are left static for purposes of flushing and cleaning. Refer to System Piping Diagrams on the Drawings for suggested locations of temporary connections for flushing and cleaning purposes.
- C. Select three locations for monitoring flow rates.

### 3.2 INITIAL FLUSHING

- A. Remove loose dirt, mill scale, metal chips, weld beads, rust and other deleterious substances without damage to system components.
- B. Bypass factory cleaned equipment, unless acceptable means of protection are provided and subsequent inspection of water boxes and other "hide-out" areas takes place.
- C. Isolate or protect clean system components including pumps and pressure vessels and remove components which may be damaged.
- D. Open valves, drains, vents and strainers at all system levels.
- E. Remove plugs, caps, spool pieces and components to facilitate early discharge from system.

- F. Sectionalize system if possible to obtain debris carrying velocity of 6 FPS.
- G. Connect dead-end supply and return headers as necessary or provide terminal drains in end caps.
- H. Install temporary strainers where necessary to protect down-stream equipment.
- I. Supply and remove flushing water and drainage by fire hoses, garden hoses, temporary and permanent piping and Contractor's booster pumps.
- J. Flush for not less than one hour.
- K. Inspect system including basins to determine if debris accumulation requires dewatering and cleaning prior to next phase work.

### 3.3 FLUSHING AND CHEMICAL CLEANING PROCEDURES

- A. Remove without chemical or mechanical damage to system components adherent dirt (organic soil), oil and grease (hydrocarbons), welding and soldering flux, mill varnish, pipe compounds, rust (iron oxide), and other deleterious substances not removed by initial flushing. Removal of tightly adherent mill scale is not required.
- B. Fill system with fresh water and add manufacturer's recommended volume of system cleaner to remove grease and petroleum products from piping. Circulate solution for 48 hours at a minimum velocity of 6 fps.
  - 1. Utilize defoamers to preclude damage to existing work and adjacent electrical equipment.
  - 2. Utilize heat to maximize effectiveness of compounds or use live steam injection where practical and safe. Do not raise cleaning water temperature in excess of controlled limits.
- C. Monitor flow rates and clean strainers as required to maintain minimum specified velocity during the entire circulation and chemical cleaning period.
- D. Cleaning of new piping systems shall be completed prior to connection of systems to existing services.
- E. Install temporary strainer screens between pipe flange faces where necessary to protect primary system from branch connections during chemical cleaning procedures.
- F. Following chemical cleaning:
  - 1. Remove, clean, and reinstall strainer baskets.
  - 2. Blow down and clean low points, dirt legs, and traps.
- G. Drain systems:
  - 1. Check with local authorities concerning discharge requirements and submit copies of letters or reports.
  - 2. If acceptable, drain system to sanitary drainage system.
  - 3. Do not under any circumstances drain to storm drainage system or open drainage ditch.

4. If discharge requirements do not allow discharge to sanitary sewer, secure the services of a licensed disposal Contractor.
5. Disposal Contractors:
  - a. Dynecol.
  - b. SQS Environmental.

H. Perform final flush to remove any remaining debris and chemical from the system:

1. Flush dead ends and isolated pre-cleaned equipment.
2. Operate valves to dislodge debris in valve body.
3. Flush for not less than 1 hour.

### 3.4 PLACING INTO OPERATION

- A. Clean strainers.
- B. Dewater and clean new sumps, basins, storage vessels and pressure vessels.
- C. Disassemble, inspect, clean, repair, replace and reassemble any critical component or questionable item. Bellows style, and hose and braid flexible connectors left in place shall be removed and cleaned.
- D. Preliminarily adjust control valves.
- E. Install clean primary filter elements, if necessary, as determined by both pressure differential across filter and visual inspection of filter elements.
- F. Close-up and fill system as soon as possible to minimize corrosion of untreated surfaces.
- G. Vent air from system and adjust fill valve.
- H. Immediately after completion of flushing and chemical cleaning, fill systems with potable water and make ready for chemical treatment as specified in Division 23 Section "Water Treatment for Closed-Loop Hydronic Systems."

### 3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  1. Withdraw, inspect, and test samples of water from each system after flushing and chemical cleaning is completed, to ensure system is free of contaminants.
  2. If loose debris or contaminants are still present, repeat final flushing procedures until test samples and strainers remain free of debris and contaminants.

END OF SECTION 232510



SECTION 232513 - WATER TREATMENT FOR CLOSED-LOOP HYDRONIC SYSTEMS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 23 Section "Piping Systems Flushing and Chemical Cleaning."

1.2 DEFINITIONS

- A. CPVC: Chlorinated Polyvinyl Chloride.
- B. EEPROM: Electrically erasable, programmable read-only memory.
- C. EPDM: Ethylene-propylene-diene monomer.
- D. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
- E. RO: Reverse osmosis.

- F. TDS: Total dissolved solids.
- G. TSS: Total suspended solids are solid materials, including organic and inorganic, that are suspended in the water. These solids may include silt, plankton, and industrial wastes.
- H. PTFE: Polytetrafluoroethylene.
- I. UV: Ultraviolet.

### 1.3 PERFORMANCE REQUIREMENTS

- A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.
- B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
- C. Base chemical quantities on estimated system size.
- D. Closed hydronic systems, including hot-water heating with non-aluminum boilers, chilled water, and snow melting, shall have the following water qualities:
  - 1. pH: Maintain a value within 9.0 to 10.5.
  - 2. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
  - 3. Boron: Maintain a value within 100 to 200 ppm.
  - 4. Soluble Copper: Maintain a maximum value of 0.20 ppm.
  - 5. TDS: Maintain a maximum value of 5000 mmhos.
  - 6. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
  - 7. Microbiological Limits:
    - a. Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
    - b. Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
    - c. Ammonia: Maintain a maximum value of 20 ppm.
    - d. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
    - e. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
    - f. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

### 1.4 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for the following products:
  - 1. Bypass feeders.
- B. Shop Drawings: Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to HVAC systems. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: Power and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For sensors, injection pumps, and controllers to include in operation and maintenance manuals.
  1. Submit under provisions of Division 20 Section "Mechanical General Requirements" and as supplemented in this Section.
  2. Submit following operation and maintenance data as minimum for purified water system.
    - a. Furnish complete instruction manuals for installation, operation, maintenance, and lubrication requirements for each component of mechanical and electrical equipment or system.
    - b. Each instruction manual shall include, but not be limited to, the following:
      - 1) Diagrams and illustrations.
      - 2) Detailed description of the function of each principal component of the system.
      - 3) Performance and nameplate data.
      - 4) Installation instructions.
      - 5) Procedures for starting.
      - 6) Proper adjustment.
      - 7) Test procedures and recording of operation data.
      - 8) Procedures for operating.
      - 9) Shutdown and restart instructions.
      - 10) Emergency operating instructions and trouble-shooting guide.
      - 11) Safety precautions.
      - 12) Maintenance and overhaul instructions which shall include detailed assembly drawings with part numbers, recommended spare parts list, instructions for ordering spare parts (including suppliers names), and complete preventive maintenance instructions required to ensure satisfactory performance and longevity of the equipment.
      - 13) Lubrication instructions, which shall list points to be greased or oiled, shall recommend type, grade, and temperature range of lubricants, and shall recommend frequency of lubrication.
      - 14) List of electrical relay settings and control and alarm contact settings.
      - 15) Electrical interconnection wiring diagram for equipment furnished, including all control.
    - c. Manual shall be complete in all respects for all equipment, controls, accessories, and associated appurtenances.
    - d. Each O&M Manual shall be transmitted to the Owner's representative and Architect prior to installation of the equipment and all equipment shall be serviced by the manufacturer in accordance with the manufacturer's recommendations prior to operation. A service record shall be maintained on each item of equipment and shall be delivered to the Owner's representative and Architect prior to final acceptance of the project.
- E. Other Informational Submittals:

1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in the "Performance Requirements" Article above.
2. An analytical review of make-up water characteristics for each treated system operating conditions, including such items as Langlier/Ryzner Indexes. Based on this review, provide a definitive description of treatment system developed to achieve specified objectives and include generic terms to describe product formulation content and function. Detailed proprietary formulation data is not required. However, manufacturer's standard published literature is not usually acceptable.
3. A step-by-step procedure to be followed by the Contractor during flushing, purging, disinfecting, draining, disposal, pretreatment and treatment operations. The intent of the step-by-step procedure is two-fold.
  - a. To assure that all essential permanent provisions to accomplish the above work are included during the course of construction.
  - b. To allow the Owner to accomplish the source procedures as subsequent maintenance operations.

F. Provide OSHA equivalent materials form for hazardous substances.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Conform to applicable codes for addition of non-potable chemicals to building mechanical systems, and for delivery to public sewage systems.

#### 1.6 OWNER'S INSTRUCTIONS

- A. Provide a coordinated water treatment training program oriented to the needs common to operating personnel and maintenance personnel and to the needs of maintenance personnel only, sufficiently prior to acceptance of the work, upon mutually satisfactory arrangement with the Architect.
- B. Provide a total of not less than eight "field" hours encompassing mechanical, electrical, chemical, pollution and safety aspects, sufficient for personnel to operate and maintain systems and consistently achieve specified objectives, with subsequently scheduled guidance by the water treatment laboratory.
- C. Water treatment laboratory chemical engineer, complemented by instrument engineer, supplemented by Contractor's staff, shall comprise the training staff.
- D. Training materials shall include "survey," limits control program, shop drawings, operating and maintenance manuals, safe handling of chemicals, chemical testing, use of log sheets and demonstrations of installed and functioning systems.
- E. On completion of the installation of the entire purified water system, conduct a thorough check and test of all components in the system. During this period, instruct the Owner's personnel in the theory, operation, and maintenance of the system. When this work is finished, start up the system and operate it for as long as

necessary to complete two consecutive days of operation at the specified performance levels. During this period, continue to instruct the Owner's personnel.

## 1.7 MAINTENANCE SERVICE

- A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion, scale formation, and biological growth for chilled-water piping, heating, hot-water piping, and snow melt piping, and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion, and shall include the following:
1. Provide piping/plumbing recommendation to optimize chemical program results.
  2. Initial water analysis and HVAC water-treatment recommendations.
  3. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
  4. Quarterly field service and consultation.
  5. Customer report charts and log sheets.
  6. Laboratory technical analysis.
  7. Analyses and reports of all chemical items concerning safety and compliance with government regulations.
- B. Glycol manufacturer shall provide testing services every six months of samples submitted by the Owner. Fluid shall be tested at no charge for: glycol percent, pH, reserve alkalinity, dissolved metals, magnesium, calcium, chlorides, acidity, and inhibitor components. Testing service shall be for the life of the fluid.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers/Suppliers: Unless otherwise specified, and subject to compliance with requirements, provide products by one of the following:
1. Ashland Specialty Chemical Company; Drew Industrial Div.
  2. Eldon Water. (Patrick Racine, Christa Blades, or Pierre Beausoleil, 888-712-4000).
  3. Enerco Corporation. (Doug White 517-627-8444 or 800-292-5908).
  4. GE Power & Water; Water & Process Technologies.
  5. Mitco Custom Water Treatment (Gordon Chapin, 800-516-2175).
  6. Nalco, an Ecolab Company (734-751-2387).
  7. H-O-H Chemicals, Inc. (H.V. Burton Co., 734-261-4220)

### 2.2 MANUAL CHEMICAL-FEED EQUIPMENT

- A. Bypass Feeders: Steel, with corrosion-resistant exterior coating, minimum 3-1/2-inch fill opening in the top, and NPS 3/4 bottom inlet and top side outlet. Quarter turn or threaded fill cap with gasket seal and diaphragm to lock the top on the feeder when exposed to system pressure in the vessel.
1. Capacity: 5 gal.
  2. Minimum Working Pressure: 125 psig.

## 2.3 GLYCOL FEED SYSTEM

### A. Manufacturers:

1. Armstrong Pumps Inc.; GLA Series.
2. Bell & Gossett; Xylem Inc.; GMU.
3. Eldon Water.
4. H.V. Burton Co.; J.L. Wingert Co.
5. John Wood Company (The); Automatic Glycol Make-Up System JWGP-54-055.
6. Mitco Custom Water Treatment; Advantage Controls inc.; AGF Series.
7. Skidmore Pump.

### B. Description: Pre-piped and pre-wired system, consisting of a glycol pump, tank, adjustable differential pressure switch, pressure gage, and control panel.

### C. Chemical Tank Assembly:

1. Tank: Industrial grade polyethylene with removable cover.
2. Tank Capacity: 50 to 55 gallons.
3. Support Frame: Welded steel.
4. Discharge Piping: ASTM A53 black or galvanized steel, or Type L copper. PVC or CPVC discharge piping is unacceptable.
5. Include suction strainer, drain fitting, and interconnecting suction piping to the chemical pump.
6. Containment: Low profile, forkliftable, spill pallet or containment basin with volume large enough to hold contents of largest tank.
  - a. Construction: High-density polyethylene.
  - b. Grates: Removable with non-slip surface.

### D. Glycol Pump: Positive displacement type with capacity adjustable through 100 percent of range by means of an easily accessible control. The pump shall be adjustable while running, and the pumped fluid shall not contact any metals of the drive assembly. Pump motor maximum 1/2 horsepower, 115 volts/single-phase/60 hertz, with a minimum capacity of 1.5 GPH at discharge pressure minimum 20 percent greater than the indicated system pressure at point of fill,

### E. Hand/Off/Auto Motor Starters: Mounted on skid for glycol pump.

### F. Control Panel: Furnished with the chemical tank assembly. Control panel shall be the master control center for all electrical equipment associated with the chemical tank assembly and shall include:

1. Hand/Off/Auto Switch: For the glycol pump. The pump shall run continuously while the switch is in the HAND position.
2. LED Indicator: For loss of pressure.
3. Enclosure: NEMA 250 Type 4X, with all controls, switches, and indicating lights mounted on the front.
4. Power Connection: Minimum 6-foot power cord and cap.
5. Low Tank Level Interlock Alarm Circuit: To prevent the glycol pump from running dry. Circuit shall include pump lockout, tank level detector, visual alarm, audible alarm, and alarm silence button. Interlock circuit shall automatically reset when tank is refilled.

## 2.4 CHEMICAL FEED PIPE AND FITTINGS

### A. Stainless-Steel Pipes And Fittings:

1. Stainless-Steel Tubing: Comply with ASTM A 269, Type 316.
2. Stainless-Steel Fittings: Complying with ASTM A 815/A 815M, Type 316, Grade WP-S.
3. Two-Piece, Full-Port, Stainless-Steel Ball Valves: ASTM A 351, Type 316 stainless-steel body; ASTM A 276, Type 316 stainless-steel stem and vented ball, carbon-filled TFE seats, threaded body design with adjustable stem packing, threaded ends, and 250-psig SWP and 600.

## 2.5 CHEMICAL TREATMENT TEST EQUIPMENT

- ### A. Test Kit: Manufacturer-recommended equipment and chemicals in a wall-mounting cabinet for testing pH, TDS, inhibitor, chloride, alkalinity, and hardness; sulfite and testable polymer tests for high-pressure boilers, and oxidizing biocide test for open cooling systems.
- ### B. Corrosion Test-Coupon Assembly (Corrosion Racks): Constructed of corrosive-resistant material, complete with piping, valves, and mild steel and copper coupons. Locate copper coupon downstream from mild steel coupon in the test-coupon assembly.
1. Two-station rack for closed-loop systems.
  2. Include 1-inch diameter, chemical resistant acrylic flowmeter suitable for 1 to 20 gpm at exit of coupon rack.

## 2.6 CHEMICALS

- ### A. Inhibited Propylene Glycol: Single nationally marketed brand of propylene glycol, inhibited for industrial applications, and readily available in bulk quantities from a firm offering free testing and advisory service to bulk users as to inhibitor replenishment needs. Premix inhibited glycol solution and deionized water to specified concentration. Automotive anti-freeze is unacceptable.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dow Chemical; Dowfrost HD.
    - b. Eldon Water.
    - c. Houghton Chemical Corporation.
    - d. Interstate Chemical Company; Intercool P300.
    - e. Nalco, an Ecolab Company.
    - f. PVS-Nolwood Chemicals, Inc.; Chill PGHD.

## PART 3 - EXECUTION

### 3.1 WATER ANALYSIS

- #### A. Perform an analysis of supply water to determine quality of water available at Project site.

### 3.2 INSTALLATION

- A. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.
- B. Install water testing equipment on wall near water chemical application equipment.
- C. Install meters and equipment requiring service at a maximum 60 inches above finished floor.
- D. Install interconnecting control wiring for chemical treatment controls and sensors.
- E. Mount sensors and injectors in piping circuits.
- F. Bypass Feeders: Install in closed hydronic systems, including hot-water heating, and chilled water, and equipped with the following:
  - 1. Install bypass feeder in a bypass circuit on main header having pressure differential greater than or equal to 20 psig, unless otherwise indicated on Drawings.
  - 2. Install water meter in makeup water supply.
  - 3. Install test-coupon assembly in bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
  - 4. Install a gate or full-port ball isolation valves on inlet, outlet, and drain below feeder inlet.
  - 5. Install a swing check on inlet after the isolation valve.
- G. Install glycol feed system in accordance with manufacturers instructions.

### 3.3 GLYCOL INSTALLATION

- A. Clean and flush glycol system before adding premixed glycol solution.
- B. Fill systems indicated to have antifreeze or glycol solutions with the following premixed concentrations. Batch feeding of glycol is prohibited.
  - 1. Hot-Water Heating Piping: Minimum 35 percent propylene glycol.
- C. Perform tests determining strength of glycol and water solution and submit written test results.

### 3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings. Dielectric fittings are specified in Division 20 Section "Basic Mechanical Materials and Methods."



- D. Install make-up water meters where indicated on the drawings.
- E. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Division 20 Section "Valves."
- F. Refer to Division 22 Section "Domestic Water Piping Specialties" for backflow preventers required in makeup water connections to potable-water systems.
- G. Confirm applicable electrical requirements in Division 26 Sections for connecting electrical equipment.
- H. Ground equipment according to Division 26 Section "Grounding and Bonding."
- I. Connect wiring according to Division 26 Section "Conductors and Cables."

### 3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Tests and Inspections:
  - 1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
  - 2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
  - 3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.
  - 4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
  - 5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
  - 7. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
  - 8. Repair leaks and defects with new materials and retest piping until no leaks exist.
- C. Equipment will be considered defective if it does not pass tests and inspections.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Sample boiler water at one-week intervals after boiler startup for a period of five weeks, and prepare test report advising Owner of changes necessary to adhere to Part 1 "Performance Requirements" Article for each required characteristic. Sample boiler water at eight -week intervals following the testing noted above to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section.

- F. At eight -week intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to adhere to Part 1 "Performance Requirements" Article.
- G. Comply with ASTM D 3370 and with the following standards:
  - 1. Silica: ASTM D 859.
  - 2. Steam System: ASTM D 1066.
  - 3. Acidity and Alkalinity: ASTM D 1067.
  - 4. Iron: ASTM D 1068.
  - 5. Water Hardness: ASTM D 1126.

### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.

END OF SECTION 232513

SECTION 233113 - METAL DUCTS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 23 Section "Nonmetal Ducts" for fabric ducts, fibrous-glass ducts, thermoset FRP ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
  - 3. Division 23 Section "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
  - 4. Division 23 Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

## 1.2 SUMMARY

- A. This Section includes metal ducts for supply, return, outside, relief air, and exhaust air-distribution systems.

## 1.3 DEFINITIONS

- A. Duct Sizes: Inside clear dimensions. For lined ducts, maintain sizes inside lining.
- B. Low Pressure: Up to and including 2 inch WG and velocities less than 1,500 fpm.
- C. Medium Pressure: Greater than 2 inch WG to 6 inch WG and velocities greater than 1,500 fpm and less than 2,500 fpm.
- D. High Pressure: Greater than 6 inch WG to 12 inch WG and velocities greater than 2,500 fpm.
- E. FRP: Fiberglass-reinforced plastic.
- F. PVC: Polyvinyl Chloride.

## 1.4 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

## 1.5 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Application Schedule" Article.

## 1.6 SUBMITTALS

- A. Shop Drawings: Drawn to scale. Show fabrication and installation details for metal ducts. Shop drawings shall be reviewed and approved by the Architect prior to any fabrication.
  - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
  - 2. Duct layout indicating sizes and pressure classes.
  - 3. Elevations of top and bottom of ducts.
  - 4. Dimensions of main duct runs from building grid lines.
  - 5. Fittings.
  - 6. Reinforcement and spacing.
  - 7. Seam and joint construction.

8. Penetrations through fire-rated and other partitions.
9. Equipment installation based on equipment being used on Project.
10. Duct accessories, including access doors and panels.
11. Hangers and supports, including methods for duct and building attachment, vibration isolation.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Other systems installed in same space as ducts.
3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

C. Welding certificates.

D. Field quality-control test reports.

#### 1.7 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

C. Comply with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations," Ch. 3, "Duct System," for range hood ducts, unless otherwise indicated.

D. Duct Liner Maximum Temperature Limits: Based on ASTM C 411 test procedures.

#### 1.8 COORDINATION

A. Sheet metal trades shall cooperate fully with the Laboratory Airflow Controls Trades and shall attend all field installation training sessions.

B. Sheet metal trades shall cooperate fully with the Test and Balance Contractor and provide all miscellaneous caps and any other materials required for structural integrity and leakage testing of the complete duct system in whole or in part. Refer to Division 23 Section "Testing, Adjusting and Balancing."

1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

- C. Sheet metal trades shall participate in the above ceiling coordination program. Refer to Division 01 requirements.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation.
- C. PVC-Coated Galvanized Steel: Acceptable by authorities having jurisdiction for use in fabricating ducts with UL 181, Class 1 listing. Lock-forming-quality, galvanized sheet steel complying with ASTM A 653/A 653M and having G60 coating designation. Factory-applied PVC coatings shall be 4 mils thick on interior sheet metal surfaces of ducts and fittings exposed to corrosive conditions and minimum 1 mil thick on exterior surfaces.
- D. Reinforcement Shapes and Plates:
  - 1. Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
  - 2. Compatible materials for aluminum and stainless-steel ducts.
- E. Tie Rods:
  - 1. Galvanized Steel Duct: Galvanized steel, 3/8-inch minimum diameter.
  - 2. Ducts in Humid or Corrosive Atmospheres: Stainless steel, 1/4-inch diameter for lengths 36 inches or less; 3/8-inch diameter for lengths longer than 36 inches.

### 2.3 ZERO-CLEARANCE PREFABRICATED RANGE HOOD EXHAUST DUCT

- A. Manufacturers:
  - 1. AMPCO; American Metal Products; Model IVSI-4ZC.
  - 2. Metal-Fab Inc.; Model IPIC-3G/4G.
  - 3. Schebler Chimney Systems; FyreGuard.
  - 4. Selkirk Inc.; Selkirk Metalbestos; ZeroClear Z3.

- B. Description: Factory-fabricated, -listed, and -labeled, double-wall ducts tested according to UL 1978 and rated for 500 deg F continuously, or 2000 deg F for 30 minutes; with positive or negative duct pressure and complying with NFPA 211, and suitable for zero-clearance installations.
- C. Construction: Inner shell and outer jacket separated by a 3-inch to 4-inch annular space filled with high-temperature, ceramic-fiber insulation.
  - 1. Inner Shell: ASTM A 666, Type 304 stainless steel.
  - 2. Outer Jacket: Aluminized steel indoors and Type 304 stainless steel outdoors. Seams shall be fully welded.
- D. Gaskets and Flanges: Ensure that gaskets and sealing materials are rated at 1500 deg F minimum.
- E. Hood Connectors: Constructed from same material as grease duct with internal or external continuously welded or brazed joints.
- F. Accessories: Tees, elbows, increasers, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly. Include unique components required to comply with NFPA 96 including cleanouts, transitions, adapters, and drain fittings.
- G. Grease Duct Supports: Construct duct bracing and supports from non-combustible material.
  - 1. Design bracing and supports to carry static and seismic loads within stress limitations of the International Building Code.
  - 2. Ensure that bolts, screws, rivets and other mechanical fasteners do not penetrate duct walls.

#### 2.4 SEALANTS AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Elastomeric Sealant Tape: 3 inches wide; modified butyl adhesive backed.
  - 1. Manufacturers:
    - a. Hardcast; Foil-Grip 1402 and Foil-Grip 1402-181BFX.
- C. Water-Based Joint and Seam Sealant:
  - 1. Manufacturers:
    - a. Design Polymerics; DP1010 Water Based Duct Sealant.
    - b. Hardcast; Flex-Grip 550 and Versa-Grip 181.
    - c. Polymer Adhesives; No. 11.
    - d. United McGill.
  - 2. Application Method: Brush on.

3. Solids Content: Minimum 63 percent.
4. Shore A Hardness: Minimum 20.
5. Water resistant.
6. Mold and mildew resistant.
7. VOC: Maximum 75 g/L (less water).
8. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
9. Service: Indoor or outdoor.
10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Manufacturers:
  - a. Hardcast; Sure-Grip 404.
  - b. United McGill.
2. Application Method: Brush on.
3. Base: Synthetic rubber resin.
4. Solvent: Toluene and heptane.
5. Solids Content: Minimum 60 percent.
6. Shore A Hardness: Minimum 60.
7. Water resistant.
8. Mold and mildew resistant.
9. VOC: Maximum 395 g/L.
10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

F. Gaskets: Chloroprene elastomer, 40 durometer, 1/8 inch thick, full face, one piece vulcanized or dovetailed at joints.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

## 2.5 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
- B. Hanger Materials: Galvanized sheet steel or threaded steel rod.



1. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
  2. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
  3. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
  4. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials. Attachments for stainless steel and PVC-coated duct shall be stainless steel.
- D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
  3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.
- E. Load Rated Cable Suspension System for Noncorrosive Environments: Tested to five times the Safe Working Loads and verified by the SMACNA Testing and Research Institute.
1. Cable: Aircraft quality 7 x 7 and 7 x 19 wire rope.
    - a. Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
    - b. Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
  2. Fastener: One-piece, die-cast zinc housing with Type 302 S26 stainless steel hardened and tempered springs, and oil impregnated, sintered, hardened and tempered steel locking wedges.
  3. End Fixings: Loop, stud or toggle; or plain end suitable for wire rope beam clamp.
  4. Manufacturers:
    - a. Ductmate Industries, Inc.; Clutcher and EZ-Lock.
    - b. Duro Dyne Corp.; Dyna-Tite System.
    - c. Gripple Inc.; Hang-Fast System.
- F. Stainless Steel Load Rated Cable Suspension System for Corrosive Environments: Tested to five times the Safe Working Loads and verified by the SMACNA Testing and Research Institute.
1. Cable: Aircraft quality stainless steel 7 x 7 and 7 x 19 wire rope.
    - a. Stainless steel complying with ASTM A 492.
  2. Fastener: One-piece, stainless steel housing with Type 302 S26 stainless steel hardened and tempered springs, and ceramic locking wedges.
  3. End Fixings:
    - a. Loop End: Type 316L/A4 stainless steel.

- b. Stud or Toggle End: Type 304L/A2 stainless steel.
  - c. Plain end suitable for stainless steel wire rope beam clamp.
4. Manufacturers:
- a. Ductmate Industries, Inc.; Clutcher and EZ-Lock.
  - b. Duro Dyne Corp.; Dyna-Tite System.
  - c. Gripple Inc.; Hang-Fast System.
- G. Welded Supports: Structural steel shapes with zinc rich paint. Equivalent, proprietary design, rolled steel structural support systems may be used in lieu of mill rolled structural steel.

## 2.6 RECTANGULAR DUCT FABRICATION

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards-Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
- 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
  - 2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards-Metal and Flexible."
  - 3. Internal Tie Rods: As allowed by SMACNA's "HVAC Duct Construction Standards-Metal and Flexible."
- B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's and SMACNA guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
1. Manufacturers:
- a. Ductmate Industries, Inc.
  - b. Nexus Inc.
  - c. Ward Industries, Inc.
- C. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

## 2.7 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

- A. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.
- B. Round and Flat-Oval, Spiral Lock-Seam Ducts:
1. Manufacturers:
- a. Eastern Sheet Metal (ESM).
  - b. LaPine Metal Products.
  - c. Linx Industries (previously Lindab USA); a DMI Company.
  - d. McGill AirFlow Corporation.

- e. SEMCO Incorporated.
  - f. SET Duct Manufacturing, Inc.
  - g. Tangent Air, Inc.
  - h. Universal Spiral Air.
- C. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" or SMACNA "Industrial Duct Construction Standards" as required based on pressure class.
1. Round fittings shall be factory fabricated welded design. Use of field fabricated fittings (welded design) shall only be permitted when factory fabricated fittings are unavailable.
- D. Flat-Oval, Spiral Lock-Seam Ducts: Fabricate supply ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" or SMACNA "Industrial Duct Construction Standards" as required based on pressure class.
1. Flat-oval fittings shall be factory fabricated welded design. Use of field fabricated fittings (welded design) shall only be permitted when factory fabricated fittings are unavailable.
- E. Duct Joints:
1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
  2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
  3. Ducts Larger Than 72 Inches in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards-Metal and Flexible," Figure 3-2.
  4. Bolts and fasteners for galvanized steel duct shall be carbon steel, zinc coated per ASTM A153. Bolts and fasteners for stainless steel and polyvinyl chloride coated steel duct shall be stainless steel.
  5. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
    - a. Manufacturers:
      - 1) AccuDuct Mfg. Inc.
      - 2) Ductmate Industries, Inc.
      - 3) Eastern Sheet Metal (ESM).
      - 4) Linx Industries (previously Lindab USA); a DMI Company.
      - 5) Universal Spiral Air.
  6. Flat-Oval Ducts: Prefabricated connection system consisting of two flanges and one synthetic rubber gasket.
    - a. Manufacturers:
      - 1) AccuDuct Mfg. Inc.
      - 2) Ductmate Industries, Inc.
      - 3) Eastern Sheet Metal (ESM).
      - 4) Linx Industries (previously Lindab USA); a DMI Company.
      - 5) McGill AirFlow Corporation.
      - 6) SEMCO Incorporated.

7) Universal Spiral Air.

- F. Low Pressure Ductwork (plus or minus 2 inches W.G. Static Pressure Class)
1. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible provide single thickness turning vanes.
  2. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.
- G. Medium and High Pressure Ductwork (For Static Pressure Class Greater than plus or minus 2 inches W.G.)
1. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible provide single thickness turning vanes.
  2. Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.
  3. Fabricate continuously welded medium and high pressure round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
  4. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.
- H. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.
- I. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.
- J. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
  2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:
    - a. Ducts 3 to 36 Inches in Diameter: 0.034 inch.
    - b. Ducts 37 to 50 Inches in Diameter: 0.040 inch.
    - c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
    - d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.
  3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:
    - a. Ducts 3 to 26 Inches in Diameter: 0.034 inch.
    - b. Ducts 27 to 50 Inches in Diameter: 0.040 inch.
    - c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
    - d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.

4. Flat-Oval Mitered Elbows: Welded construction with same metal thickness as longitudinal-seam flat-oval duct.
5. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
6. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
7. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
8. Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
9. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
10. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
11. Flat-Oval Elbow Metal Thickness: Same as longitudinal-seam flat-oval duct specified above.
12. Pleated Elbows for Sizes through 14 Inches in Diameter and Pressures through 10-Inch wg: 0.022 inch.

K. PVC-Coated Elbows and Fittings: Fabricate elbows and fittings as follows:

1. Round Elbows 4 to 8 Inches in Diameter: Two-piece, die stamped, with longitudinal seams spot welded, bonded, and painted with PVC aerosol spray.
2. Round Elbows 9 to 26 Inches in Diameter: Standing-seam construction.
3. Round Elbows 28 to 60 Inches in Diameter: Standard gored construction, riveted and bonded.
4. Other Fittings: Riveted and bonded joints.
5. Couplings: Slip-joint construction with a minimum 2-inch insertion length.

### PART 3 - EXECUTION

#### 3.1 DUCTWORK APPLICATION SCHEDULE

- A. Ductwork materials and performance requirements are scheduled on the Drawing.

#### 3.2 DUCT INSTALLATION

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards-Metal and Flexible," unless otherwise indicated.
- B. Install round and flat-oval ducts in lengths not less than 12 feet unless interrupted by fittings.
- C. Install ducts with fewest possible joints.
- D. Install fabricated fittings for changes in directions, size, and shape and for connections.

- E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.
- F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.
- N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, and sleeves. Fire and smoke dampers are specified in Division 23 Section "Duct Accessories."
  - 1. Where ducts not having fire dampers, smoke dampers, or combination fire and smoke dampers pass through fire-rated partitions, maintain indicated fire rating. Seal penetrations with firestop materials. Refer to Division 07 Specification Sections for materials and UL classified firestop systems.
- O. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.
- P. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
  - 1. Intermediate level.

### 3.3 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

### 3.4 EQUIPMENT INSTALLATION

- A. Install venturi terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance. Refer to details for additional requirements.

### 3.5 DUCT SEALING

- A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards-Metal and Flexible" for duct pressure class indicated. Ducts must be properly cleaned and sealed in strict accordance with sealant manufacturer's instructions.
  - 1. Seal Class: Refer to Application Schedule on the Drawings.
  - 2. Seal ducts before external insulation is applied.
  - 3. After pressure testing, remake leaking joints until leakage is equal to or less than maximum allowable. Refer to Application Schedule on the Drawings for allowable leakage rates.

### 3.6 RANGE HOOD EXHAUST DUCTS, SPECIAL INSTALLATION REQUIREMENTS

- A. Install ducts to allow for thermal expansion through 2000 deg F temperature range.
- B. Install ducts without dips or traps that may collect residues unless traps have continuous or automatic residue removal.
- C. Install access openings at each change in direction and at intervals defined by NFPA 96; locate on sides of duct a minimum of 1-1/2 inches from bottom; and fit with grease-tight covers of same material as duct.
- D. Install welded test ports or prefabricated test port section in the exhaust duct for the duct Pitot-tube traverse. Install each test port with a threaded cap that is liquid tight.
- E. Do not penetrate fire-rated assemblies except as permitted by applicable building codes.
- F. Field Quality Control:
  - 1. Prior to use or concealment of any portion of grease duct system, perform leakage test in presence of Code Official.
  - 2. Light test or approved equivalent test method shall be performed to determine that welded and brazed joints are liquid tight.
  - 3. Lamp shall be not less than 100 watts and shall be open to emit light equally in all directions perpendicular to duct walls.

### 3.7 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- C. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at maximum intervals of 16 feet.
- D. Install concrete inserts before placing concrete.
- E. Support ductwork from building structure, not from roof deck, floor slab, pipe, other ducts, or equipment.
- F. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- G. Install roof mounted duct supports in accordance with manufacturer's instructions. Provide additional membrane layer or walkpads under support bases as required.
- H. Use load rated cable suspension system for round duct in exposed locations.

### 3.8 CONNECTIONS

- A. Make connections to equipment with flexible connectors according to Division 23 Section "Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards-Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.9 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

### 3.10 FIELD QUALITY CONTROL

- A. Duct System Cleanliness Tests:
  - 1. Visually inspect duct system to ensure that no visible contaminants are present.
- B. Duct system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.



3.11 START UP

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing."

END OF SECTION 233113

SECTION 233300 - DUCT ACCESSORIES

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 23 Section "Testing, Adjusting, and Balancing" for duct test holes.
  - 3. Division 23 Section "Temperature Controls" for motorized control dampers.
  - 4. Division 28 Section "Fire Alarm" for duct-mounting fire and smoke detectors.

1.2 DEFINITIONS

- A. NVLAP: National Voluntary Laboratory Accreditation Program.
- B. Low Pressure: Up to 2 inch WG and velocities less than 1,500 fpm. Construct for 2 inch WG positive or negative static pressure.

- C. Medium Pressure: Greater than 2 inch WG to 6 inch WG and velocities greater than 1,500 fpm and less than 2,500 fpm. Construct for 6 inch WG positive or negative static pressure.
- D. High Pressure: Greater than 6 inch WG to 12 inch WG and velocities greater than 2,500 fpm. Construct for 12 inch WG positive or negative static pressure.

### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. For turning vanes, include data for pressure loss generated sound power levels.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
  - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
    - a. Special fittings.
    - b. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
    - c. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.
- D. Source quality-control reports.
- E. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

### 1.4 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

### 1.5 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed for each temperature rating.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation.
- C. Stainless Steel: ASTM A 480/A 480M, Types 304 and 316 as indicated.
- D. Extruded Aluminum: ASTM B 221, alloy 6063, temper T6.
- E. Bird Screens: No. 2 mesh, 0.063 inch diameter galvanized wire screen with open area of not less than 72 percent. Conceal sharp edges by adding metal edging consisting of rod, flat or angle iron, or 16 gage galvanized sheet steel turned over at least 3/4 inch on both sides.

### 2.3 LOW PRESSURE MANUAL VOLUME DAMPERS

- A. Manufacturers:
  - 1. American Warming and Ventilating.
  - 2. Arrow United Industries.
  - 3. Greenheck.
  - 4. Krueger.
  - 5. Louvers and Dampers.
  - 6. Nailor Industries Inc.
  - 7. Ruskin Company.
  - 8. Vent Products Company, Inc.
  - 9. Young Regulator Company.
- B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
  - 1. Except for dampers in round ductwork sized 12 inches and smaller, provide end bearings.
- C. Rectangular Volume Dampers: Multiple-opposed-blade design, AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications.

- D. Round Volume Dampers 16-inch Diameter and Smaller: Single-blade design, AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications.
- E. Round Volume Dampers Larger than 16-inch Diameter: Multiple-opposed-blade design AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications.
- F. Damper Materials:
  - 1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
  - 2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
  - 3. Blade Axles: Galvanized steel.
  - 4. Bearings: Oil-impregnated bronze, molded synthetic, or stainless-steel sleeve type.
  - 5. Tie Bars and Brackets: Galvanized steel.
- G. Jackshaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
  - 1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.
- H. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

## 2.4 MEDIUM OR HIGH PRESSURE MANUAL VOLUME DAMPERS

- A. Manufacturers:
  - 1. American Warming and Ventilating.
  - 2. Greenheck.
  - 3. Louvers and Dampers.
  - 4. Nailor Industries Inc.
  - 5. Ruskin Company.
  - 6. Vent Products Company, Inc.
- B. General Description: Factory fabricated, galvanized steel or extruded aluminum construction, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
- C. Rectangular Volume Dampers: Multiple-opposed-blade design, AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications. Construction and assembly such that no noise producing blade vibration occurs at velocities 20 percent greater than maximum system design velocity.

- D. Round Volume Dampers 16-inch Diameter and Smaller: Single-blade, or multiple-opposed-blade design, AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications. Construction and assembly such that no noise producing blade vibration occurs at velocities 20 percent greater than maximum system design velocity.
- E. Round Volume Dampers Larger than 16-inch Diameter: Multiple-opposed-blade design, AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications. Construction and assembly such that no noise producing blade vibration occurs at velocities 20 percent greater than maximum system design velocity.
- F. Damper Materials:
  - 1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
  - 2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
  - 3. Aluminum Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
  - 4. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
  - 5. Blade Axles: Galvanized steel or stainless steel.
  - 6. Bearings: Oil-impregnated bronze, molded synthetic, or stainless-steel sleeve type.
  - 7. Tie Bars and Brackets: Aluminum or galvanized steel.
- G. Jackshaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
  - 1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.
- H. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

## 2.5 FIRE DAMPERS (CURTAIN STYLE)

- A. Manufacturers:
  - 1. Air Balance, Inc.
  - 2. Greenheck.
  - 3. NCA Manufacturing, Inc.
  - 4. Nailor Industries Inc.
  - 5. Ruskin Company.
- B. Dynamic fire dampers with curtain style blades, and labeled according to UL 555, maximum velocity 2000 fpm, maximum static pressure 4 inches w.g.
- C. Fire Rating:
  - 1. 1-1/2 hours for 2 hour rated walls.

2. 3 hours for 4 hour rated walls.
- D. Frame: Type B or Type C Curtain type with blades outside airstream; fabricated with roll-formed, galvanized steel in gages required by manufacturer's UL listing; with mitered and interlocking corners.
- E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
  1. Thickness: Equal to or thicker than the duct connected to it, and of length to suit application.
  2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.
- F. Mounting Orientation: Vertical or horizontal as indicated.
- G. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- H. Fusible Links: Replaceable, 212 deg F rated.

## 2.6 FIRE DAMPERS (MULTIPLE BLADE TYPE)

- A. Manufacturers:
  1. Greenheck.
  2. NCA Manufacturing, Inc.
  3. Nailor Industries Inc.
  4. Ruskin Company.
- B. Dynamic fire dampers with multiple blades, and labeled according to UL 555, maximum velocity of 2000 fpm, maximum static pressure 4 inches w.g.
- C. Fire Rating:
  1. 1-1/2 hours for 2 hour rated walls.
  2. 3 hours for 4 hour rated walls.
- D. Frame: Fabricated with roll-formed, galvanized steel in gages required by manufacturer's UL listing; with mitered and interlocking corners.
- E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
  1. Thickness: Equal to or thicker than the duct connected to it, and of length to suit application.
  2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.
- F. Mounting Orientation: Vertical or horizontal as indicated.
- G. Blades: Parallel operation, single-piece airfoil type construction with 0.078 inch equivalent thickness, or 0.064 inch thick, roll-formed, triple v-groove.

- H. Axles: 1/2 inch plated steel hex.
- I. Bearings: Stainless steel, or oil-impregnated bronze sleeve type, pressed into frame.
- J. Linkage: Concealed in frame.
- K. Fusible Links: Replaceable, 212 deg F rated.

## 2.7 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers:
  - 1. Air Balance, Inc.
  - 2. Greenheck.
  - 3. Nailor Industries Inc.
  - 4. NCA Manufacturing, Inc.
  - 5. Ruskin Company.
- B. General Description: Combination fire and smoke dampers shall be labeled according to UL 555 and UL 555S. Leakage shall not exceed 10 cfm per square foot at 1 inch WG differential pressure (Leakage Class II).
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.
- D. Fire Rating:
  - 1. 1-1/2 hours for 2 hour rated walls.
  - 2. 3 hours for 4 hour rated walls.
- E. Frame and Blades: 0.064-inch- thick, galvanized sheet steel.
- F. Mounting Sleeve: Factory-installed, galvanized sheet steel.
  - 1. Thickness: Equal to or thicker than the duct connected to it, and of length to suit application.
- G. Rated pressure and velocity to exceed design airflow conditions.
- H. Damper Actuators: Electric modulating or two-position action as required.
  - 1. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
  - 2. Size for torque required for damper seal at load conditions.
  - 3. Overload Protection: Microprocessor or an electronic based motor controller providing burnout protection if stalled before full rotation is reached. The actuator shall be electronically cut off at full open to eliminate noise generation with the holding noise level to be inaudible.
  - 4. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
  - 5. Power Requirements (Two-Position Spring Return): 24 or 120 V ac.
  - 6. Power Requirements (Proportional): Maximum (running) 12 VA at 24-V ac or 8 W at 24-V dc. Maximum (holding) 5VA at 24-V ac or 3 W at 24-V dc holding.



7. Proportional Actuators (24V ac/dc): Control signal shall be 0-10vdc, 2-10vdc or 4-20mA as required to operate with associated controller. Include position feedback signal for 0-10vdc, 2-10vdc or 4-20mA as required to be monitored by associated controller.
  8. Actuator timing shall meet 15 sec.
  9. Temperature Rating: Actuator shall have a UL555S listing by the damper manufacturer for 250 deg F.
- I. Manual Heat Responsive Fuse Link with Reset and Damper Blade Position End Switches: Factory installed manual heat responsive fuse link with reset switch / damper position switch package for both full open and full closed indication (equivalent to Ruskin TS150 switch package).
  - J. Test Switch: Damper Remote mounted momentary "test" push-button switch rated for 24V or 120V as required to allow testing and/or maintenance of motorized dampers.
    1. Include damper remote mounted "open" and "closed" indication lights on switch plate for connection to factory installed damper blade position end switches.

## 2.8 TURNING VANES

### A. Manufactured Turning Vanes:

1. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
2. Double-vane or airfoil-shaped, curved blades of galvanized sheet steel set into vane runners suitable for duct mounting.
3. Generated sound power level shall not exceed 54 decibels in octave band 4 at 2000 fpm in a 24-inch by 24-inch duct.
4. Manufacturers:
  - a. Aero/Dyne Company; H-E-P Turning Vanes.
  - b. Ductmate Industries, Inc.
  - c. Duro Dyne Corp.
  - d. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

### B. Manufactured Acoustic Turning Vanes:

1. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
2. Double-vane curved blades of galvanized sheet steel with perforated faces and fibrous-glass fill set into vane runners suitable for duct mounting.
3. Manufacturers:
  - a. Ductmate Industries, Inc.
  - b. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

## 2.9 DUCT-MOUNTING ACCESS DOORS

- A. General Description: Fabricate doors airtight and suitable for duct pressure class. Doors may be field fabricated in accordance with SMACNA Standards, or commercially produced.
- B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.
  - 1. Manufacturers:
    - a. Air Balance, Inc.
    - b. Greenheck.
    - c. Nailor Industries Inc.
    - d. Ruskin Company.
  - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
  - 3. Provide number of hinges and locks as follows:
    - a. Less Than 12 Inches Square: Secure with two sash locks.
    - b. Up to 18 Inches Square: Two hinges and two compression locks.
    - c. Up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
    - d. Sizes 24 by 48 Inches and Larger: One additional hinge.
- C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch thickness. Include cam latches.
  - 1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. Flexmaster U.S.A., Inc.
  - 2. Frame: Galvanized sheet steel, with spin-in notched frame.
- D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
- E. Insulation: 1-inch-thick, fibrous-glass or polystyrene-foam board.

## 2.10 FLEXIBLE CONNECTORS

- A. Manufacturers:
  - 1. ADSCO Manufacturing LLC.
  - 2. Duro Dyne Corp.
  - 3. Senior Flexonics Pathway.
  - 4. Ventfabrics, Inc.
- B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

- C. Metal-Edged Connectors: Factory fabricated with a fabric strip minimum 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Select metal compatible with ducts.
- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
  - 1. Minimum Weight: 26 oz./sq. yd.
  - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
  - 3. Service Temperature: Minus 20 to plus 200 deg F.
- E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
  - 1. Minimum Weight: 24 oz./sq. yd.
  - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
  - 3. Service Temperature: Minus 50 to plus 250 deg F.
- F. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.
  - 1. Minimum Weight: 16 oz./sq. yd.
  - 2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
  - 3. Service Temperature: Minus 67 to plus 500 deg F.
- G. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.
  - 1. Minimum Weight: 14 oz./sq. yd.
  - 2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
  - 3. Service Temperature: Minus 67 to plus 500 deg F.

## 2.11 FLEXIBLE DUCTS, LOW AND MEDIUM PRESSURE

- A. Manufacturers:
  - 1. Flexmaster U.S.A., Inc.; a Masterduct Company; Type 1M Acoustical.
  - 2. Hart & Cooley.
  - 3. Thermaflex; part of the Flexible Technologies Group.
- B. Flexible Ducts: Interlocking spiral of galvanized steel or aluminum construction or fabric supported by helically wound spring steel wire or flat steel bands; rated to 6 inches WG positive and 4 inches WG negative for low and medium pressure ducts.
- C. Insulated Flexible Ducts: UL 181, Class 1, flexible duct wrapped with flexible glass fiber insulation, enclosed by a fire retardant polyethylene vapor barrier jacket; maximum 0.23 K value at 75 deg F.

- D. Acoustical performance tested in accordance with the Air Diffusion Council's *Flexible Air Duct Test Code FD 72-R1, Section 3.0, Sound Properties* shall be as follows:

The insertion loss (dB) of a 10 foot length of straight duct when tested in accordance with ASTM E477, at a velocity of 2500 feet per minute, shall be minimum:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
6" diameter	8	32	38	35	39	25
8" diameter	13	32	36	35	36	21
12" diameter	15	29	28	33	26	14

The radiated noise reduction (dB) of a 10 foot length of straight duct when tested in accordance with ASTM E477, at a velocity of 2500 feet per minute, shall be minimum:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
6" diameter	6	8	7	8	9	13
8" diameter	9	6	6	7	8	10
12" diameter	9	7	6	6	8	11

The self-generated sound power levels (LW) dB are 10-12 Watt of a 10 foot length of straight duct for an empty sheet metal duct when tested in accordance with ASTM E477, at a velocity of 1000 feet per minute, shall not exceed:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
6" diameter	42	31	23	18	17	21
8" diameter	41	34	27	19	18	21
12" diameter	53	44	36	27	21	22

- E. Flexible Duct Fittings: Galvanized steel, twist-in design with damper. Size as indicated.
- F. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 through 18 inches to suit duct size.

## 2.12 FLEXIBLE DUCTS HIGH PRESSURE

- A. Manufacturers:
1. Flexmaster U.S.A., Inc.; a Masterduct Company; Type 3M.
  2. Hart & Cooley.
  3. Thermaflex; part of the Flexible Technologies Group.
- B. Flexible Ducts: Interlocking spiral of galvanized steel or aluminum construction or fabric supported by helically wound spring steel wire or flat steel bands; rated to 12 inches WG positive and 4 inches WG negative for medium and high pressure ducts.
- C. Insulated Flexible Ducts: UL 181, Class 1, flexible duct wrapped with flexible glass fiber insulation, enclosed by seamless aluminum pigmented plastic vapor barrier jacket; maximum 0.23 K value at 75 deg F.

- D. Flexible Duct Fittings: Galvanized steel, twisted-in design with damper. Size as indicated.
- E. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 through 18 inches to suit duct size.

#### 2.13 FLEXIBLE DUCT ELBOW SUPPORTS

- A. Manufacturer:
  - 1. Thermaflex; part of the Flexible Technologies Group; FlexFlow Elbow.
  - 2. Smart Air & Energy Solutions; SMART Flow Elbow.
- B. Elbow supports shall be constructed of durable composite material and be fully adjustable to support flexible duct diameters 6 inches through 16 inches.
- C. Elbow supports shall be UL listed for use in return air plenum spaces.

#### 2.14 DUCT ACCESSORY HARDWARE

- A. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

### PART 3 - EXECUTION

#### 3.1 APPLICATION AND INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards-Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts and PVC coated ducts; and aluminum accessories in aluminum ducts.
- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
  - 1. Install steel volume dampers in steel ducts.
  - 2. Install stainless steel volume dampers in stainless steel ducts.
  - 3. Install aluminum volume dampers in aluminum ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install fire dampers, combination fire and smoke dampers, and smoke dampers according to UL listing.
- F. Install duct silencers rigidly to ducts.

- G. Install duct access doors on ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
  - 1. On upstream side of duct coils.
  - 2. Upstream from duct filters.
  - 3. At outdoor-air intakes and mixed-air plenums.
  - 4. At drain pans.
  - 5. Downstream from control dampers, backdraft dampers, and duct mounted equipment.
  - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links.
  - 7. Control devices requiring inspection, including airflow measuring devices. Size access doors appropriately to facilitate service of each device.
  - 8. Elsewhere as indicated.
  
- H. Install access doors with swing against duct static pressure.
  
- I. Install duct-mounting, rectangular access doors with long dimension at right angles to direction of airflow and of largest standard size which can be accommodated in duct. Maximum size: 21 by 14 inches.
  
- J. Install pressure relief doors vertically and level in accordance with manufacturer's instructions, between the fan and first operable damper.
  
- K. Label access doors according to Division 20 Section "Mechanical Identification."
  
- L. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.
  
- M. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
  
- N. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
  
- O. Connect diffusers or light troffer boots to low pressure ducts flexible duct clamped or strapped in place.
  
- P. Connect flexible ducts to metal ducts with draw bands.
  
- Q. Install flexible duct elbow supports at each diffuser, grille, or register, and elsewhere as indicated.
  
- R. Install turning vanes in rectangular duct elbows in excess of 45 degrees, and where indicated:
  - 1. Use manufactured double-vane turning vanes unless otherwise specified.
  - 2. Seat outboard-most vane in heel of duct elbow.
  - 3. Provide vanes for all runner punchings, practice of eliminating every other vane is prohibited.
  - 4. Use single-vane turning vanes in low pressure square elbows.

### 3.2 FIELD QUALITY CONTROL

#### A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

### 3.3 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Adjust fire dampers, combination fire and smoke dampers, and smoke dampers for proper action.
- C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

END OF SECTION 233300

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Motors."
  - 3. Division 23 Section "Common Work Results for HVAC" for common mechanical drive requirements for fans and air moving equipment.

1.2 PERFORMANCE REQUIREMENTS

- A. Classify according to AMCA 99.

1.3 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
  - 1. Certified fan performance curves with system operating conditions indicated.
  - 2. Certified fan sound-power ratings.
  - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 4. Material thickness.



5. Dampers, including housings, linkages, and operators.
  6. Roof curbs.
  7. Fan speed controllers.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
1. Wiring Diagrams: Power, signal, and control wiring.
  2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
  3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
- C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
1. Roof framing and support members relative to duct penetrations.
  2. Ceiling suspension assembly members.
  3. Size and location of initial access modules for acoustical tile.
  4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For power ventilators to include in operation and maintenance manuals.
- 1.4 QUALITY ASSURANCE
- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

## 1.6 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- C. Coordinate delivery and placement of roof curbs, and equipment supports. Installation of roof curbs, equipment supports, and roof penetrations is specified in Division 07 Section "Roof Accessories."

## 1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Belts: One set for each belt-drive unit.

## PART 2 - PRODUCTS

### 2.1 CENTRIFUGAL ROOF VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Acme Engineering & Mfg. Corp.; Models PRN and PV.
  - 2. Aerovent; a Twin City Fan Company.
  - 3. Greenheck; Models G and GB.
  - 4. Loren Cook Company; Models ACED and ACEB.
  - 5. Moffitt Corporation, Inc.
  - 6. PennBarry; a unit of Tomkins PLC; Domex.
- B. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.
- C. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
- D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- E. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
  - 1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
  - 2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
  - 3. Sheaves: Cast-iron, adjustable-pitch motor sheave.
  - 4. Fan and motor isolated from exhaust airstream.
  - 5. Refer to Division 23 Section "Common Work Results for HVAC" for additional requirements.

- F. Accessories:
  - 1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
  - 2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
- G. Provide prefabricated roof curbs for each fan.
- H. Capacities and Characteristics: Refer to schedule(s) on Drawings.

## 2.2 KITCHEN HOOD EXHAUST FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Acme Engineering & Mfg. Corp.; Models PDURG and PNURG.
  - 2. Aerovent; a Twin City Fan Company.
  - 3. Greenheck; CUBE Series.
  - 4. JencoFan; Div. of Breidert Air Products.
  - 5. Loren Cook Company.
  - 6. Moffitt Corporation, Inc.
  - 7. PennBarry; a unit of Tomkins PLC; Fumex with Fatrap.
- B. Description: UL 762 labeled belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, heat baffle, curb base, and accessories.
- C. Housing: Spun-aluminum construction with square, one-piece, aluminum base with venturi inlet cone. Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains, grease collector, and drain connection.
  - 1. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.
- D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- E. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
  - 1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
  - 2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
  - 3. Sheaves: Cast-iron, adjustable-pitch motor sheave.
  - 4. Fan and motor isolated from exhaust airstream.
  - 5. Refer to Division 23 Section "Common Work Results for HVAC" for additional requirements.
- F. Accessories:
  - 1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
  - 2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
- G. Provide prefabricated roof curbs for each fan. Provide vented curb extension as required to locate fan discharge at a minimum of 40 inches above the roof.

- H. Capacities and Characteristics: Refer to schedule(s) on Drawings.

### 2.3 ROOF CURBS AND ACCESSORIES

- A. Construction: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch chemically treated wood nailer. Size as required to suit roof opening and fan base.
1. Manufacturers: Roof curbs shall be provided by the fan manufacturer, or one of the following:
    - a. Creative Metals.
    - b. Pate.
    - c. Roof Products & Systems.
    - d. ThyCurb.
    - e. Any of the approved roof mounted exhaust fan manufacturers.
  2. Configuration: Self-flashing without a cant strip, with mounting flange, and suitable for flat roofs with tapered insulation.
  3. Height: Curb shall extend a minimum 18 inches above top surface of roof insulation.
- B. Construction: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch chemically treated wood nailer. Size as required to suit roof opening and fan base.
1. Manufacturers: Roof curbs shall be provided by the fan manufacturer, or one of the following:
    - a. Creative Metals.
    - b. Pate.
    - c. Roof Products & Systems.
    - d. ThyCurb.
    - e. Any of the approved roof mounted exhaust fan manufacturers.
  2. Configuration: Built-in raised cant with step dimension matching insulation thickness, with mounting flange, and suitable for sloped roofs with uniform insulation thickness.
  3. Height: Curb shall extend a minimum 18 inches above top surface of roof insulation.
  4. Pitch Mounting: Manufacture curb for roof slope, top of curb shall be level.
- C. Roof Curb Extensions and Adapters:
1. Manufacturers: Roof curbs shall be provided by the fan manufacturer, or one of the following:
    - a. Creative Metals.
    - b. Pate.
    - c. Roof Products & Systems.
    - d. ThyCurb.
    - e. Any of the approved roof mounted exhaust fan manufacturers.

2. Curb Extensions: Constructed of minimum 18 ga. galvanized steel.
  - a. 4-inch high construction with no damper shelf and no damper access.
  - b. 8-inch high construction with damper shelf; and removable panel, or access door.
  - c. 12-inch high construction with damper shelf; and removable panel, or access door (minimum required for motorized damper).
3. Curb Adapters: Constructed of minimum 18 ga. galvanized steel and designed to adapt or reduce curb cap dimensions to match new fans to existing roof curbs.

#### 2.4 MOTORS

- A. Comply with requirements in Division 20 Section "Motors."

#### 2.5 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Install floor-mounting units as specified in Division 20 Section "Mechanical Vibration Controls."
- C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- D. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Division 20 Section "Mechanical Vibration Controls."
- E. Install units with clearances for service and maintenance.
- F. Label units according to requirements specified in Division 20 Section "Mechanical Identification."

### 3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Verify that shipping, blocking, and bracing are removed.
  - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  - 3. Verify that cleaning and adjusting are complete.
  - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  - 5. Adjust belt tension.
  - 6. Adjust damper linkages for proper damper operation.
  - 7. Verify lubrication for bearings and other moving parts.
  - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
  - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  - 10. Shut unit down and reconnect automatic temperature-control operators.
  - 11. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### 3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor sheaves as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION 233423

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 23 Section "Metal Ducts."
  - 3. Division 23 Section "Temperature Controls."

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.
  - 1. Liners and adhesives.
  - 2. Sealants and gaskets.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Include a schedule showing unique model designation, room location, model number, size, and accessories furnished.
  - 2. Wiring Diagrams: Power, signal, and control wiring.

- C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Ceiling suspension assembly members.
  - 2. Method of attaching hangers to building structure.
  - 3. Size and location of initial access modules for acoustical tile.
  - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- D. Operation and Maintenance Data: For air terminal units to include in operation and maintenance manuals. Include the following:
  - 1. Instructions for resetting minimum and maximum air volumes.
  - 2. Instructions for adjusting software set points.

### 1.3 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- C. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

### 1.4 COORDINATION

- A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 SINGLE-DUCT AIR TERMINAL UNITS

- A. Manufacturers:
  - 1. Anemostat; a Mestek Company.
  - 2. Krueger; Tomkins PLC.



3. Nailor Industries of Texas Inc.
  4. Price Industries.
  5. Titus; Tomkins PLC.
  6. Tuttle & Bailey; Tomkins PLC.
- B. Configuration: Variable and constant volume, medium pressure terminal units with casing, 100 percent tight shutoff volume regulator, velocity sensor, and sound attenuating thermal insulation.
- C. Casing: Constructed of 0.034-inch mill galvanized steel or 0.032-inch aluminum.
1. Casing Lining: 1-inch- thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive. Cover liner with nonporous foil.
  2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
  3. Air Outlet: S-slip and drive connections, size matching inlet size.
  4. Access: Removable panels for access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket.
- D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: AHRI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
- E. Velocity Sensor: Multipoint averaging array. Sensor located in air inlet.
- F. Attenuator Section: 0.034-inch mill galvanized steel or 0.032-inch aluminum sheet metal.
1. Lining: 1-inch- thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive. Cover liner with nonporous foil.
- G. Hot-Water Heating Coil: Copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig; and factory installed.
- H. DDC Controls: Single-package unitary controller and actuator specified in Division 23 Section "Temperature Controls."
- I. Control Sequence: Refer to Temperature Control Diagrams on Drawings.

## 2.3 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Steel Cables: Galvanized steel complying with ASTM A 603.
- C. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- D. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

- E. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

## 2.4 SOURCE QUALITY CONTROL

- A. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and AHRI certification seal.
- B. Verification of Performance: Rate air terminal units according to AHRI 880.
- C. Acoustical Applications and Sound Evaluation: Based on AHRI Standard 885-98, "Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets."

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

### 3.2 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts or structural-steel fasteners appropriate for construction materials to which hangers are being attached. Refer to Division 20 Section "Hangers and Supports" for additional information.
  - 1. Where practical, install concrete inserts before placing concrete.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to air terminal units to allow service and maintenance.

- C. Hot Water Piping: Unless otherwise indicated:
  - 1. Install union and isolation valve on supply-water connection.
  - 2. Install union and calibrated balancing valve or PICCV as indicated on the Drawings on return-water connection.
  - 3. Hydronic specialties are specified in Division 23 Section "Hydronic Piping."
- D. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."
- E. Ground units with electric heating coils according to Division 26 Section "Grounding and Bonding."
- F. Connect wiring according to Division 26 Section "Conductors and Cables."
- G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
  - 2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.

### 3.5 STARTUP SERVICE

- A. Complete installation and startup checks according to manufacturer's written instructions and do the following:
  - 1. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
  - 2. Verify that controls and control enclosure are accessible.
  - 3. Verify that control connections are complete.
  - 4. Verify that nameplate and identification tag are visible.
  - 5. Verify that controls respond to inputs as specified.

### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 233600

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 10 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
  - 2. Division 20 Section "Mechanical General Requirements."
  - 3. Division 23 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 SUBMITTALS

- A. Product Data: For each product indicated, include the following:
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Ceiling suspension assembly members.
  - 2. Method of attaching hangers to building structure.
  - 3. Size and location of initial access modules for acoustical tile.
  - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
  - 5. Duct access panels.

## PART 2 - PRODUCTS

### 2.1 AIR DIFFUSION DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Krueger-HVAC; Air Distribution Technologies, Inc.; a JCI Company.
  - 2. Nailor Industries, Inc.
  - 3. Price Industries.
  - 4. Titus; Air Distribution Technologies, Inc.; a JCI Company.
  - 5. Tuttle & Bailey; Air Distribution Technologies, Inc.; a JCI Company.
- B. Terminal air diffusion devices have been chosen in terms of specific air distribution requirements, spacing, and sound characteristics.
- C. Provide plaster frames for units installed in plaster ceilings.
- D. Provide gaskets for supply terminal air devices mounted in finished surfaces.
- E. Finish:
  - 1. Device Face and Visible Trim: Standard off white baked enamel finish unless noted otherwise.
  - 2. Device Interior Surfaces, Including Blank-Offs and Boots: Black matte finish.
- F. Air pattern adjustments shall be made from the face of the device.
- G. Refer to drawings and schedules for quantities, types, and finishes.
- H. Coordinate frame types with Architectural Reflected Ceiling Plan.

### 2.2 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."
- B. Acoustical Applications and Sound Evaluation: Based on ARI Standard 885-98, "Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Wall-Mounted Supply Registers: Install 6 inches below finished ceiling unless otherwise indicated.
- D. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

### 3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 235100 - BREECHING, CHIMNEYS, AND STACKS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 23 Section "Draft Control Devices" for induced-draft and mechanical fans and motorized and barometric dampers.
  - 4. Division 23 Section "Metal Ducts" for double-wall factory fabricated grease duct.

1.2 SUBMITTALS

- A. Product Data: For the following:
  - 1. Special gas vents.
  - 2. Guy wires and connectors.
- B. Shop Drawings: For vents, breeching, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, methods of field assembly, components, hangers, and location and size of each field connection.
  - 2. Provide engineered sizing data.

### 1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain listed system components through one source from a single manufacturer.
- B. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

### 1.4 COORDINATION

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Combustion-Air Intake: Complete system, stainless steel, pipe, vent terminal with screen, inlet air coupling, and sealant.

### 2.2 LISTED SPECIAL GAS VENT

- A. Manufacturers:
  - 1. Cleaver-Brooks, Inc.; CBHL.
  - 2. Heat-Fab, Inc.; Model Saf-T Vent Cl.
  - 3. Metal-Fab Inc.; Model Corr/Guard.
  - 4. Schebler Chimney Systems; eVent.
  - 5. Security Chimneys International; Secure Seal SSD.
  - 6. Selkirk Inc.; Selkirk Metalbestos; Model DCV.
  - 7. Van-Packer Co.; Model CS.
- B. Description: Double-wall metal vents tested according to UL 1738 and rated for 550 deg F continuously, with positive, negative, or neutral flue pressure, complying with NFPA 211 and suitable for condensing gas-fired appliances.
- C. Construction: Inner shell and outer jacket separated by at least 3/32-inch airspace.
- D. Inner Shell: ASTM A 959, Type 29-4C stainless steel.
- E. Outer Jacket: Aluminized steel indoors and Type 304 stainless steel outdoors.
- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
  - 1. Termination: Round chimney top design to exclude 98 percent of rainwater. A "Pointed Hat" stack cap is not acceptable.
  - 2. Termination: Adjustable wall thimble and horizontal termination with bird screen.



### 2.3 GUYING AND BRACING MATERIALS

A. Cable: Galvanized, stranded wires of the following thickness:

1. Minimum Size: 1/4 inch in diameter.
2. For ID Sizes 4 to 15 Inches: 5/16 inch.
3. For ID Sizes 18 to 24 Inches: 3/8 inch.
4. For ID Sizes 27 to 30 Inches: 7/16 inch.
5. For ID Sizes 33 to 36 Inches: 1/2 inch.
6. For ID Sizes 39 to 48 Inches: 9/16 inch.
7. For ID Sizes 51 to 60 Inches: 5/8 inch.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLICATION

- A. Listed Special Gas Vent: Condensing gas appliances, and direct vented finned water-tube boilers and water heaters.

### 3.3 INSTALLATION OF LISTED VENTS, CHIMNEYS AND STACKS

- A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing, local regulations, or NFPA 211, whichever is most stringent.
- B. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
- C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.
- D. Slope breeching down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.

### 3.4 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

- B. Clean breeching internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.
- C. Provide temporary closures at ends of breeching, chimneys, and stacks that are not completed or connected to equipment.

END OF SECTION 235100

SECTION 235216 - CONDENSING BOILERS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 23 Section "Breeching, Chimneys, and Stacks."

1.2 SUMMARY

- A. Receive, handle, and install four Owner furnished Aerco Benchmark condensing boilers that will be delivered FOB jobsite.

1.3 SUBMITTALS

- A. Coordination Drawings: Floor plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Structural supports.
  - 2. Piping roughing-in requirements.
  - 3. Wiring roughing-in requirements, including spaces reserved for electrical equipment.

4. Access requirements, including working clearances for mechanical controls and electrical equipment, and tube pull and service clearances.

- B. Field quality-control test reports.

#### 1.4 COORDINATION

- A. Coordinate size and location of concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

### PART 2 - PRODUCTS

#### 2.1 STAINLESS STEEL VERTICAL FIRE-TUBE CONDENSING BOILERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AERCO International; Benchmark Series.
2. Cleaver Brooks model CFCE Series.
3. Viessmann
4. Buderus
5. Superior Boiler

- B. Description: Factory-fabricated, -assembled, and -tested, vertical fire-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls. Water heating service only.

- C. Heat Exchanger: Corrosion-resistant stainless steel combustion chamber.

- D. Pressure Vessel: Stainless steel with welded heads and tube connections.

- E. Burner: Natural gas, forced draft.

- F. Blower: Centrifugal fan to operate during each burner firing sequence and to prepurge and postpurge the combustion chamber.

1. Motors: Comply with requirements specified in Division 20 Section "Motors."

- a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

- G. Gas Train: Combination gas valve with manual shutoff and pressure regulator.

- H. Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.

- I. Casing:

1. Jacket: Sheet metal, with snap-in or interlocking closures.
2. Control Compartment Enclosures: NEMA 250, Type 1A.

3. Finish: Baked-enamel or powder-coated protective finish.
4. Insulation: Minimum 2-inch- thick, mineral-fiber or polyurethane-foam insulation surrounding the heat exchanger.
5. Combustion-Air Connections: Inlet and vent duct collars.
6. Mounting base to secure boiler.

J. Characteristics and Capacities: Refer to Schedule on Drawings.

## 2.2 HOT-WATER BOILER TRIM

- A. Include devices sized to comply with ANSI B31.1, "Power Piping and ANSI B31.9, "Building Services Piping."
- B. Aquastat Controllers: Operating, firing rate, and high limit.
- C. Safety Relief Valve: ASME rated.
- D. Pressure and Temperature Gage: Minimum 3-1/2-inch- diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
- E. Boiler Air Vent: Manual.
- F. Drain Valve: Minimum NPS 3/4 hose-end gate valve.
- G. Circulation Pump: Non-overloading, in-line pump with split-capacitor motor having thermal-overload protection and lubricated bearings; designed to operate at specified boiler pressures and temperatures.

## 2.3 CONTROLS

- A. Refer to Drawing M2.0. Hot water heating boiler control diagram (For Reference).
- B. Boiler sequencing panel that has Campus BMS interface compatibility.
- C. Boiler operating controls shall include the following devices and features:
  1. Control transformer.
  2. Set-Point Adjust: Set points shall be adjustable.
  3. Sequence of Operation: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain space temperature in response to thermostat with heat anticipator located in heated space.
  4. Sequence of Operation: Electric, factory-fabricated and field-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 0 deg F outside-air temperature, set supply-water temperature at 200 deg F; at 60 deg F outside-air temperature, set supply-water temperature at 140 deg F.
    - a. Include automatic, alternating-firing sequence for multiple boilers to ensure maximum system efficiency throughout the load range and to provide equal runtime for boilers.

5. Provide contacts for connection to remote shutdown switch(es). Activation of remote shutdown switch shall cut power to the burner controls. Refer to Division 23 Section "Temperature Controls" for remote shutdown switches.
- D. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
1. High Cutoff: Automatic reset stops burner if operating conditions rise above maximum boiler design temperature.
  2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be automatic-reset type.
  3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
  4. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.
- E. Building Management System Interface: Factory install hardware and software to enable building management system to monitor, control, and display boiler status and alarms.
1. Hardwired Points:
    - a. Monitoring: On/off status, common trouble alarm and low water level alarm.
    - b. Control: On/off operation, hot water supply temperature set-point adjustment.
  2. A communication interface with building management system shall enable building management system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building management system.

## 2.4 ELECTRICAL POWER

- A. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
1. House in NEMA 250, Type 1 enclosure.
  2. Wiring shall be numbered and color-coded to match wiring diagram.
  3. Install factory wiring outside of an enclosure in a metal raceway.
  4. Field power interface shall be to lockable, nonfused disconnect switch.
  5. Provide branch power circuit to each motor and to controls with a disconnect switch or circuit breaker.
  6. Provide each motor with overcurrent protection.

## 2.5 ACCESSORIES

- A. Flue Side Condensate Neutralizer:
1. Description: Designed to raise the PH level of flue side condensate to near neutral prior to condensate entering the sanitary drainage system.

2. Materials: Neutralizer constructed of PVC pipe and fittings mounted on channel strut base with galvanized or stainless steel clamps and hardware; and charged with calcium carbonate.
3. Manufacturers:
  - a. Axion Industries Ltd.; NeutraPal and NeutraPro Series.
  - b. BKI Industries, Inc.; Acid Neutralizer Kits.
  - c. J.J.M. Boiler Works; JM Neutralizing Tubes.
  - d. Neutrasafe Corporation; Neutra-Safe Condensate Neutralizers.
  - e. Any of the approved boiler manufacturers.

## 2.6 SOURCE QUALITY CONTROL

- A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
- B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
- C. Allow Owner access to source quality-control testing of boilers. Notify Architect 14 days in advance of testing.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.
  1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.
- B. Examine mechanical spaces for suitable conditions where boilers will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 BOILER INSTALLATION

- A. Install boilers level on concrete base. Concrete base is specified in Division 20 Section "Basic Mechanical Materials and Methods," and concrete materials and installation requirements are specified in Division 03.
- B. Install natural gas-fired boilers according to NFPA 54.
- C. Assemble and install boiler trim.
- D. Install electrical devices furnished with boiler but not specified to be factory mounted.

- E. Install control wiring to field-mounted electrical devices.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to boiler to allow service and maintenance.
- C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
- D. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service. Flexible connectors and their installation are specified in Division 20 Section "Pipe Flexible Connectors, Expansion Fittings and Loops."
- E. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
- F. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.
- G. Install piping from safety relief valves to nearest floor drain.
- H. Boiler Venting:
  - 1. Connect full size to boiler connections. Comply with requirements in Division 23 Section "Breechings, Chimneys, and Stacks."
- I. Ground equipment according to Division 26 Section "Grounding and Bonding."
- J. Connect wiring according to Division 26 Section "Conductors and Cables."

### 3.4 FIELD QUALITY CONTROL

- A. A factory-authorized service representative will perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. Perform installation and startup checks according to manufacturer's written instructions.
  - 2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
    - a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.
    - b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.



- C. Remove and replace malfunctioning units and retest as specified above.
- D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

### 3.5 DEMONSTRATION

- A. A factory-authorized service representative will train Owner's maintenance personnel to adjust, operate, and maintain boilers.

END OF SECTION 235216

SECTION 237413 - MODULAR AND SEMI-CUSTOM CENTRAL-STATION AIR-HANDLING UNITS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 23 Section "Common Work Results for HVAC" for common mechanical drive requirements for fans and air handling equipment.

## 1.2 SUMMARY

- A. This Section includes indoor, central-station air-handling unit AHU-21H with the following components and accessories as scheduled on the Drawings:
  - 1. Chilled water-cooling coils.
  - 2. Hot water heating coils (35% Glycol).
  - 3. Supply fan.
  - 4. Return fan
  - 5. Economizer outdoor- and return-air damper section.
  
- B. This Section includes indoor, central-station air-handling unit AHU-22H with the following components and accessories as scheduled on the Drawings:
  - 1. 100% fresh air unit (Kitchen Exhaust Air Makeup)
  - 2. Chilled water-cooling coils.
  - 3. Hot water heating coils (35% Glycol).
  - 4. Supply fan.
  - 5. Outdoor air damper section.

## 1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design vibration isolation details, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

## 1.4 DEFINITIONS

- A. DDC: Direct-digital controls.

## 1.5 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Casing panels shall be self-supporting and capable of withstanding 125 percent of internal static pressures indicated, without panel joints exceeding a deflection of  $L/240$  where "L" is the unsupported span length within completed casings.

## 1.6 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's technical data for each air handling unit, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

## 1.7 INFORMATIONAL SUBMITTALS

- A. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring.

- B. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

- 1. Structural members to which air handling units will be attached.

#### 1.8 CLOSEOUT SUBMITTALS

- A. Field quality control test reports.
- B. Operation and Maintenance Data: For air handling units to include in operation and maintenance manuals.

#### 1.9 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of central station air-handling units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- B. AHRI Certification: Indoor air-handling units and their components shall be factory tested according to AHRI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by AHRI.
- C. AHRI Compliance:
  - 1. Comply with AHRI 210/240 and AHRI 340/360 for testing and rating energy efficiencies for air handling units.
  - 2. Comply with AHRI 270 for testing and rating sound performance for outdoor units.
- D. ASHRAE Compliance:
  - 1. Comply with ASHRAE 15 for refrigeration system safety.
  - 2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
  - 3. Comply with ASHRAE/IESNA 90.1 for minimum efficiency of heating and cooling.
- E. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.
- F. UL Compliance: Comply with UL 1995.
- G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.

#### 1.10 COORDINATION

- A. Coordinate size and locations of roof curbs, equipment supports, and roof penetrations. Framing, flashing, and attachment to roof structure are specified under Division 07.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.11 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Filters: One set of filters for each unit.
  2. Gaskets: One set for each access door.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Daikin Applied; a member of Daikin Industries, Ltd.
  2. JCI/YORK International Corporation.
  3. Carrier; Div. of United Technologies Corp.; 39 Series.
  4. Nortek Air Solutions; Ventrol, Venmar, and Temtrol Divisions.
  5. Trane; a Trane technologies Brand; Performance Climate Changer.

2.2 CASING

- A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed. Casing panels shall be solid double-wall construction of pre-painted galvanized steel inner and outer panels and foam insulation. Casing deflection shall not exceed a 1 to 200 ratio when subject to an internal pressure of plus or minus 5-inch wg and shall exhibit no permanent deformation at plus or minus 9-inch wg.
- B. Exterior Casing Material: Galvanized steel, knockouts with grommet seals for electrical and piping connections, and lifting lugs.
- C. Inner Casing Fabrication Requirements:
1. Fan sections shall have acoustic interior sheet uniformly perforated with 1/16 or 3/32 inch holes to produce approximately 20 percent open area.
    - a. A Mylar or Tedlar lining shall be installed between the insulation and interior sheet.
  2. Floor Plate: Galvanized steel, 0.1382 inch thick.
- D. Access Requirements: Removable panels or hinged access doors with neoprene gaskets for inspection and access to internal components.
- E. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
1. Materials: Foam panels, ASTM C 1071.
  2. Thickness: 2 inches.
  3. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.

4. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50, when tested according to ASTM C 411.
  5. Location and Application: Encased between outside and inside casing.
- F. Condensate Drain Pans: Formed sections of stainless-steel sheet, a minimum of 2 inches deep, and complying with ASHRAE 62.
1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
  2. Drain Connections: Threaded coupling or nipple.
- G. Casing Finish:
1. External surface of unit casing prepared and coated with a minimum 1.5 mil enamel finish or equal.
  2. Manufacturer's standard color.
  3. Outdoor Units: Able to withstand a salt spray test in accordance with ASTM B117 for a minimum of 500 consecutive hours.

## 2.3 FANS

### A. Centrifugal Fans:

1. General: Select fans to avoid instability in service and compute outlet areas to outlet velocities in accordance with AMCA Standards. Maintain fan duty point to the right of the peak static pressure point farthest from shut-off and at approximately 60 percent overall efficiency.
2. Description: AMCA certified, factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.
3. Housings: Formed panels to make curved-scroll housings with shaped cutoff, with doors or panels to allow access to internal parts and components.
  - a. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
  - b. Horizontally split, bolted-flange housing.
  - c. Spun inlet cone with flange.
  - d. Outlet flange.
4. Fan Wheels: Airfoil, backward-inclined, or forward-curved as indicated on Drawings.
  - a. Airfoil Wheels: Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange; heavy backplate; hollow die-formed, airfoil-shaped blades continuously welded at tip flange and backplate; and cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.
  - b. Backward-Inclined Wheels: Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange, backplate, backward-inclined blades and fastened to shaft with set screws.
  - c. Forward-Curved Wheels: Black-enameled or galvanized steel construction with inlet flange, backplate, shallow blades with inlet and tip curved forward in direction of airflow, mechanically secured to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with set screws.

5. Accessories:

- a. Scroll Access Doors: For fans larger than 18 inches in diameter, shaped to conform to scroll, with quick-opening latches and gaskets.
- b. Cleanout Door: Quick-opening gasketed door allowing access to fan scroll, of same material as housing.
- c. Scroll Drain Connection: NPS 1 steel pipe coupling welded to low point of fan scroll.
- d. Companion Flanges: Rolled flanges for duct connections of same material as housing.
- e. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
- f. Discharge Dampers: Assembly with parallel blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
- g. Inlet Screens: Grid screen of same material as housing.
- h. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
- i. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
- j. Belt guard.

6. Fan Construction:

- a. Housing Material: Reinforced steel. Metal thickness not less than minimum specified by AMCA for the class of service.
- b. Wheel Material: Steel. Metal thickness not less than minimum specified by AMCA for the class of service.
- c. Special Wheel Coating: Thermoplastic vinyl
- d. Vibration Isolators: Spring isolators having a static deflection of 1 inch.
- e. Refer to schedules on Drawings for additional requirements.

B. Plenum/Plug Fans:

1. General: Select fans to avoid instability in service and compute outlet areas to outlet velocities in accordance with AMCA Standards. Maintain fan duty point to the right of the peak static pressure point farthest from shut-off and at approximately 60 percent overall efficiency.
2. Description: AMCA certified, factory-fabricated, -assembled, -tested, and -finished, unhoused, belt-driven centrifugal plenum/plug fans consisting of wheel, fan shaft, bearings, motor, drive assembly, and support structure.
3. Airfoil Wheels: Single-width-single-inlet construction with smooth-curved inlet flange; heavy backplate; hollow die-formed, airfoil-shaped blades continuously welded at tip flange and backplate; and cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.
4. Accessories:
  - a. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
  - b. Belt guard.
  - c. Direct Drive Plenum Fans:
    - 1) Variable frequency drives.
    - 2) Motor protection box for motor current protection with a single VFD driving multiple motors.

- 3) Airflow measuring piezo ring.
- 4) Piezo ring transducer.
- 5) Motor shaft grounding ring.
- 6) Inlet guard.
- 7) Blank off plate.
- 8) Backdraft Dampers

5. Fan Construction:

- a. Wheel Material: Steel. Metal thickness not less than the minimum specified by AMCA for the class of service.
  - b. Special Wheel Coating: Thermoplastic vinyl
  - c. Vibration Isolators: Spring isolators having a static deflection of 1 inch.
  - d. Refer to schedules on Drawings for additional requirements.
  - e. Fan Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and motor horsepower.
- C. Wire sizing shall be determined, and installed, in accordance with applicable NEC standards. Each fan array and assembly shall be statically and dynamically balanced at the factory as a single rotating assembly to a quality level of G=2.5 in accordance with DIN ISO 1940-1.
1. Each fan/motor cartridge shall be removable through a 30-inch wide free area, access door located on the discharge side of the fan wall array.
- D. Motors: Premium efficiency, inverter duty, comply with requirements in Division 20 Section "Motors."
1. Enclosure Type: Totally enclosed, fan cooled (TEFC) or totally enclosed, air over (TEAO).
  2. Motors shall include permanently sealed bearings (L10/500,000 hour) and shaft grounding to protect the motor bearings from electrical discharge machining due to stray shaft currents.
- E. Motors: For equipment where specified or scheduled with ECM.
1. Synchronous, constant torque, ECM with permanent magnet rotor. Rotor magnets to be time-stable, nontoxic ceramic magnets (Sr-Fe). Motors shall be permanently lubricated.
  2. Driven by a frequency converter with an integrated power factor correction filter. Conventional induction motors will not be acceptable.
  3. Each motor with an integrated speed controller, tested as one unit by manufacturer.
  4. Motor speed adjustable over full range from 0 rpm to maximum scheduled speed.
  5. Variable motor speed to be controlled by a 0- to 10 V-dc or 4- to 20-mA input.
  6. Integrated motor protection verified by UL to protect equipment against over-/undervoltage, overtemperature of motor, electronics, or both, overcurrent, locked rotor, and dry run (no-load condition).
- F. Capacities and Characteristics: Refer to schedules on the Drawings.

2.4 COILS

- A. On outdoor units provide pipe housing on side of AHU where indicated on plans.



B. Water Coils:

1. Performance Ratings: Tested and rated according to AHRI 410 and ASHRAE 33.
2. Minimum Working-Pressure/Temperature Ratings: 200 psig, 325 deg F.
3. Source Quality Control: Factory tested to 300 psig.
4. Tubes: ASTM B 743 copper, minimum 0.020 inch wall thickness, and minimum 0.50 inch diameter.
5. Fins: Aluminum, minimum 0.010 inch thick.
6. Headers: Cast iron with cleaning plugs, and drain and air vent tappings or seamless copper tube with brazed joints, prime coated.
7. Frames, Hot Water Coils: Galvanized-steel channel frame, minimum 0.0625 inch thick.
8. Frames, Chilled Water Coils: ASTM A 666, Type 304 stainless steel, minimum 0.0625 inch thick.
9. Special Coating: Heresite P-403 baked phenolic.

2.5 FILTER SECTION

- A. Filter Section: Provide filter holding frames arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side.
- B. Filters: Size, type, and rating as scheduled on the Drawings. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
1. Air Filter Manufacturers:
    - a. AAF International.
    - b. Camfil Farr Co.
    - c. ECO Air.
    - d. Filtration Group, Inc.
    - e. Flanders Filters, Inc.

2.6 DAMPERS

- A. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.

2.7 ELECTRICAL REQUIREMENTS

- A. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to air handling unit.
1. House in NEMA 250, Type 1 enclosure.
  2. Wiring shall be numbered and color-coded to match wiring diagram.
  3. Install wiring outside of an enclosure in a metal raceway.
  4. Field power interface shall be to wire lugs.
  5. Minimum SCCR according to UL 508 shall be as indicated on the Drawings or 22,000 A, whichever is greater.

6. Each motor shall have branch power circuit and controls with one of the following disconnecting means having SCCR to match main disconnecting means:
  - a. NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
  - b. NEMA KS 1, heavy-duty, nonfusible switch.
  - c. UL 489, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.

## 2.8 CONTROLS

- A. Control equipment is specified in Division 23 Section "Temperature Controls," and sequence of operation is indicated on the Drawings.

## 2.9 ACCESSORIES

- A. Service Outlets: Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall remain energized even if the unit main disconnect is open.
- B. Lighting: Vapor-proof, marine-type, 100-watt service lights in segments indicated on Drawings. Lights shall be wired to single on/off toggle switch which brings all lights on at once. Lights shall be operable even if the main disconnect is open.
- C. Filter Differential Pressure Switch: With sensor tubing on either side of filter. Set for final filter pressure loss.

## 2.10 CAPACITIES AND CHARACTERISTICS

- A. Refer to Schedule on Drawings.

## 2.11 SOURCE QUALITY CONTROL

- A. Factory test fan performance for flow rate, pressure, power, air density, rotation speed, and efficiency. Establish ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of air handling units.
- B. Examine roughing-in for air handling units to verify actual locations of piping and duct connections before equipment installation.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION (INDOOR UNITS)

- A. Concrete Bases: Install floor mounting units on 4-inch- high concrete bases. See Division 20 Section "Basic Mechanical Materials and Methods" for concrete base materials and fabrication requirements.
- B. Hoist, transport, and rig units or their shipping sections into position following procedures recommended by manufacturer.
- C. Install indoor air-handling units with the following vibration-control devices. Vibration-control devices are specified in Division 20 Section "Mechanical Vibration Controls."
  - 1. Units with Internally Isolated Fans:
    - a. Floor-Mounted Units: Support on concrete bases using neoprene pads. Secure units to anchor bolts installed in concrete bases.
  - 2. Units without Internally Isolated Fans:
    - a. Floor-Mounted Units: Support on concrete bases using housed-spring isolators. Secure units to anchor bolts installed in concrete bases.
- D. Arrange installation of units to provide access space around indoor air-handling units for service and maintenance.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20 and 23 Sections.
- B. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
- C. Duct installation requirements are specified in other Division 23 Sections. The following are specific connection requirements.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
  - 1. After installing air handling units and after electrical circuitry has been energized, test units for compliance with requirements.
  - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.

### 3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
  - 1. Inspect for visible damage to unit casing.
  - 2. Inspect for visible damage to coils and fans.
  - 3. Inspect internal insulation.
  - 4. Verify that labels are clearly visible.
  - 5. Verify that clearances have been provided for servicing.
  - 6. Verify that controls are connected and operable.
  - 7. Verify that filters are installed.
  - 8. Remove packing from vibration isolators.
  - 9. Verify lubrication on fan and motor bearings.
  - 10. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
  - 11. Start unit according to manufacturer's written instructions.
    - a. Complete startup sheets and attach copy with Contractor's startup report.
  - 12. Inspect and record performance of interlocks and protective devices; verify sequences.
  - 13. Operate unit for an initial period as recommended or required by manufacturer.
  - 14. Calibrate thermostats.
  - 15. Adjust and inspect high-temperature limits.
  - 16. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
  - 17. Cooling System: Measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:
    - a. Coil leaving-air, dry- and wet-bulb temperatures.
    - b. Coil entering-air, dry- and wet-bulb temperatures.
    - c. Outdoor-air, dry-bulb temperature.
    - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
  - 18. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
  - 19. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
    - a. Supply-air volume.
    - b. Return-air volume.
    - c. Relief-air volume.
    - d. Outdoor-air intake volume.
  - 20. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
    - a. Low-temperature safety operation.
    - b. Filter high-pressure differential alarm.
    - c. Economizer to minimum outdoor-air changeover.
    - d. Relief-air fan operation.
    - e. Smoke and firestat alarms.

21. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

### 3.6 CLEANING AND ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.
- B. After completing system installation and testing, adjusting, and balancing air handling units and air-distribution systems, clean filter housings and install new filters.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air handling units.

END OF SECTION 237413

SECTION 238216 - HEATING AND COOLING COILS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 23 Sections for coils that are integral to air-handling units.

1.2 SUMMARY

- A. This Section includes duct-mounted heating and cooling coils, and heating and cooling coils that are an integral part of air-handling units.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each coil. Include rated capacity and pressure drop for each coil.

1.4 INFORMATIONAL SUBMITTALS

- A. Shop Drawings: Diagram power, signal, and control wiring.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which coil location and ceiling-mounted access panels are shown and coordinated with each other.

1.5 CLOSEOUT SUBMITTALS

- A. Field quality-control test reports.
- B. Operation and Maintenance Data: For air coils to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASHRAE Compliance:
  - 1. Comply with ASHRAE 15 for refrigeration system safety.
  - 2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.

PART 2 - PRODUCTS

2.1 WATER COILS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Aerofin Corporation.
  - 2. Carrier; a United Technologies Company.
  - 3. Daikin Applied; a member of Daikin Industries, Ltd.
  - 4. JCI/York International.
  - 5. Luvata/Heatcraft Commercial/Industrial Products.
  - 6. Nortek Air Solutions; Ventrol.
  - 7. Precision Coils; a business of Unison Comfort Technologies.
  - 8. Trane; a Trane Technologies Brand.
- B. Performance Ratings: Tested and rated according to AHRI 410 and ASHRAE 33.
- C. Minimum Working-Pressure/Temperature Ratings: 200 psig, 325 deg F.
- D. Source Quality Control: Factory tested to 300 psig.
- E. Tubes: ASTM B 743 copper, minimum 0.020 inch wall thickness, and minimum 0.50 inch diameter.
- F. Fins: Aluminum, minimum 0.010 inch thick.
- G. Headers: Cast iron with cleaning plugs, and drain and air vent tappings or seamless copper tube with brazed joints, prime coated.
- H. Frames, Hot Water Coils: Galvanized-steel channel frame, minimum 0.0625 inch thick.
- I. Frames, Chilled Water Coils: ASTM A 666, Type 304 stainless steel, minimum 0.0625 inch thick.

## 2.2 REFRIGERANT COILS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Aerofin Corporation.
  - 2. Carrier; a United Technologies Company.
  - 3. Daikin Applied; a member of Daikin Industries, Ltd.
  - 4. JCI/York International.
  - 5. Luvata/Heatcraft Commercial/Industrial Products.
  - 6. Nortek Air Solutions; Ventrol.
  - 7. Precision Coils; a business of Unison Comfort Technologies.
  - 8. Trane; a Trane Technologies Brand.
- B. Performance Ratings: Tested and rated according to AHRI 410 and ASHRAE 33.
- C. Minimum Working-Pressure Rating: 300 psig.
- D. Source Quality Control: Factory tested to 450 psig.
- E. Tubes: ASTM B 743 copper, minimum 0.020 inch wall thickness, and minimum 0.50 inch diameter.
- F. Fins: Aluminum, minimum 0.010 inch thick.
- G. Suction and Distributor Piping: ASTM B 88, Type L copper tube with brazed joints.
- H. Frames: ASTM A 666, Type 304 stainless steel, minimum 0.0625 inch thick.

## 2.3 DRAIN PANS

- A. Description: For cooling coils, IAQ compliant formed to slope from all directions to the drain connection as required by ASHRAE 62.
- B. Construction: Minimum 22 gage, Type 304 stainless steel with welded joints, positively sloped a minimum of 1/8 inch per foot, with threaded drain connection at lowest point of pan. Intermediate pans piped to the primary drain pan are required for all stacked cooling coils.
- C. Provide intermediate coils with 3 inch deep pans for each tiered coil bank. Top pan shall extend 6 inches beyond face of coil and bottom pan shall extend not less than 12 inches beyond face of coil. Where more than two pans are used, pan extension shall be proportional.
- D. Supports: Same material as pans.
- E. Pipe pan drain to floor drain. A deep seal trap shall be installed on the drain pipe from the pans.
- F. Include factory-installed float switch to detect high condensate water level and disable associated fan operation.



### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine ducts, plenums, and casings to receive air coils for compliance with requirements for installation tolerances and other conditions affecting coil performance.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before coil installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Install coils level and plumb.
- B. Install coils in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."
- C. Install minimum 22 gage, Type 304 stainless-steel drain pan under each cooling coil.
  - 1. Construct drain pans with connection for drain; insulated.
  - 2. Construct drain pans to extend beyond coil length and width and to connect to condensate trap and drainage.
  - 3. Extend drain pan upstream and downstream from coil face.
  - 4. Extend drain pan under coil headers and exposed supply piping.
- D. Install moisture eliminators for cooling coils. Extend drain pan under moisture eliminator.
- E. Straighten bent fins on air coils.
- F. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.

#### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to coils to allow service and maintenance.
- C. Connect water piping with unions and shutoff valves to allow coils to be disconnected without draining piping. Control valves are specified in Division 23 Section "Temperature Controls," and other piping specialties are specified in Division 23 Section "Hydronic Piping."
- D. Connect refrigerant piping according to Division 23 Section "Refrigerant Piping."

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, operate electric coils to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 238216

SECTION 238229 - ELECTRIC AND HYDRONIC RADIANT HEATING UNITS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."

1.2 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits

1.3 ACTION SUBMITTALS

- A. Product Data: Include rated capacities, specialties, and accessories for each product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Detail equipment assemblies and suspension and attachment. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring.

- B. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Suspended ceiling components.
  - 2. Structural members to which heaters and suspension systems will be attached.
  - 3. Size and location of initial access modules for acoustical tile.
  - 4. Items penetrating finished ceiling, including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
  - 5. Perimeter moldings.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Field quality-control test reports.
- B. Operation and Maintenance Data: For electric radiant heaters and panels to include in operation and maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a NRTL acceptable to authorities having jurisdiction, and marked for intended use.

#### 1.7 COORDINATION

- A. Coordinate layout and installation of radiant heaters and panels and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

### PART 2 - PRODUCTS

#### 2.1 HYDRONIC HEATING PANELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Aero Tech Manufacturing Inc.
  - 2. AIRTEX Radiant Systems; a division of Engineered Air Ltd.
  - 3. Rittling; a Zehnder Group Company.
  - 4. Armstrong Ceiling & Wall Solutions; Metalworks Airtite Radiant Ceiling Systems.
  - 5. Sterling Hydronics; a Mestek Company.
  - 6. Twa Panel Systems Inc.

- B. Description: Linear metal panel with serpentine water piping, suitable for installation flush with T-bar ceiling grid recessed mounting.
1. Panels: Fluted, extruded aluminum sheet.
  2. Backing Insulation: Minimum 1-inch- thick, mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB with factory-applied jacket.
  3. Piping Inlet and Outlet: NPS 1/2.
  4. Exposed-Side Panel Finish: Baked-enamel finish in manufacturer's standard paint color as selected by Architect.
  5. Factory Piping: ASTM B 88, Type L copper tube with ASME B16.22 wrought-copper fittings and brazed joints. Piping shall be mechanically bonded to panel.
  6. Accessories:
    - a. Matching inactive panels.
    - b. Panels with drape track recess.
    - c. Male bullnose panels.
    - d. Female bullnose panels.
    - e. Male corner panels.
    - f. Female corner panels.
    - g. Inside corner panel.
    - h. Filler panels.
- C. Capacities and Characteristics: Refer to Schedules on Drawings.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas to receive radiant heating and cooling units for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for hydronic piping connections to verify actual locations before radiant heating and cooling unit installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Install radiant heating units level and plumb.
- B. The linear radiant and matching non-radiant panels shall be installed by manufacturer's authorized Radiant Ceiling Contractor. Contractor shall install all panels in accordance with the manufacturer's recommendations.
- C. The installation of the radiant panel ceiling and matching non-radiant (inactive) panels shall be made by a single Radiant Ceiling Sub-Contractor experienced in this work. The subcontractor shall provide labor, materials, equipment, and supervision for a complete and operational system. Sub-Contractor shall submit certification of having a minimum of two (2) years previous experience in radiant ceiling installations.
  1. Contractor shall provide all necessary wall channels, angles and required support for radiant panel. Contractor shall provide tee sections between adjacent panels

and at panel ends. Contractor shall verify ceiling openings are large enough to accommodate thermal expansion and contraction of ceiling panels. The ceiling contractor shall provide and install the tee between the acoustical ceiling and the radiant panel along the length of the panel.

- D. Radiant ceiling panel suspension shall be independent of the ceiling system.
- E. Hangers shall be installed as recommended by the manufacturer.
- F. Contractor shall integrate and coordinate radiant ceiling panel installation with ceiling grid installation (by others).
- G. The Radiant Ceiling Sub-Contractor shall cooperate with other trades working in the ceiling to achieve a neat, well coordinated, and properly sequenced overall installation.
- H. Work of Radiant Ceiling Sub-contractor shall terminate within three feet of the supply and return point of each panel circuit.
- I. The Radiant Ceiling Sub-Contractor shall furnish and install all necessary piping and bends required for the interconnection of the panel sections. The panel interconnecting pipe and bends shall be furnished by the panel manufacturer and shall provide for necessary expansion and contraction as recommended by the manufacturer.
- J. All installation of linear panels, where made with mitered joints, shall be made so that the fluting on the abutting panel is aligned.
- K. Verify locations of thermostats with Drawings and room details before installation. Install devices 48 inches above finished floor.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in Division 23 Section "Hydronic Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to unit to allow service and maintenance.
- C. Water Piping: Unless otherwise indicated:
  - 1. Install union and isolation valve on supply-water connection.
  - 2. Install union and calibrated balancing valve or PICCV as indicated on the Drawings on return-water connection.
  - 3. Hydronic specialties are specified in Division 23 Section "Hydronic Piping."

### 3.4 FIELD QUALITY CONTROL

- A. Testing: Perform the following field tests and inspections and prepare test reports:
  - 1. Operate electric heating elements through each stage to verify proper operation and electrical connections.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and units.

- B. Remove and replace malfunctioning units and retest as specified above.
- C. After installing panels, inspect unit cabinet for damage to finish. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain radiant heaters and panels.

END OF SECTION 238229

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."

1.2 ACTION SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Plans, elevations, sections, and details.
  - 2. Details of custom-fabricated enclosures indicating dimensions.
  - 3. Location and size of each field connection.
  - 4. Location and arrangement of piping valves and specialties.
  - 5. Enclosure joints, corner pieces, access doors, and other accessories.
- B. Coordination Drawings: Floor plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:



1. Structural members, including wall construction, to which convection units will be attached.
  2. Method of attaching convection units to building structure.
  3. Penetrations of fire-rated wall and floor assemblies.
- C. Color Samples for Initial Selection: For units with factory-applied color finishes.
- D. Color Samples for Verification: For each type of exposed finish required.
- 1.4 CLOSEOUT SUBMITTALS
- A. Field quality-control test reports.
  - B. Operation and Maintenance Data: For convection heating units to include in emergency, operation, and maintenance manuals.
- 1.5 QUALITY ASSURANCE
- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a NRTL acceptable to authorities having jurisdiction, and marked for intended use.

## PART 2 - PRODUCTS

- 2.1 HOT-WATER OR STEAM FINNED-TUBE RADIATORS (Wall Mounted)
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    1. Rittling; A Zehnder Group Company.
    2. Sterling Hydronics; a Mestek Company.
    3. Trane; a Trane Technologies Brand.
    4. Vulcan Radiator; a Mestek Company.
  - B. Performance Ratings: Rate finned-tube radiators according to Hydronics Institute's "I=B=R Testing and Rating Standard for Finned-Tube (Commercial) Radiation."
  - C. Heating Elements: Copper tubing mechanically expanded into flanged collars of evenly spaced aluminum fins resting on element supports, ends suitable for solder fittings.
  - D. Element Supports: Ball-bearing cradle type to permit longitudinal movement on enclosure brackets.
  - E. Front Panel: Minimum 0.062-inch-thick steel.
  - F. Wall-Mounting Back Panel: Minimum 0.0329-inch- thick steel, full height, with full-length channel support for front panel without exposed fasteners.
  - G. Support Brackets: Locate at maximum 36-inch spacing to support front panel and element.

- H. Finish: Baked powder coat finish in manufacturer's standard color as selected by Architect.
- I. Damper: Knob-operated internal damper at enclosure outlet.
- J. Access Doors: Factory made, permanently hinged with tamper-resistant fastener, minimum size 6 by 7 inches, integral with enclosure.
- K. Enclosure Style: Sloped top.
  - 1. Top Outlet Grille: Punched louver; painted to match enclosure.
- L. Accessories: Filler sections, corners, relay sections, and splice plates all matching the enclosure and grille finishes.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas to receive convection heating units for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for hydronic-piping connections to verify actual locations before convection heating unit installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 FINNED-TUBE RADIATOR INSTALLATION

- A. Install units level and plumb.
- B. Install enclosure continuously around corners, using outside and inside corner fittings.
- C. Join sections with splice plates and filler pieces to provide continuous enclosure.
- D. Install access doors for access to valves.
- E. Install enclosure continuously from wall to wall.
- F. Terminate enclosures with manufacturer's end caps, except where enclosures are indicated to extend to adjoining walls.
- G. Install valves within reach of access door provided in enclosure.
- H. Install air-seal gasket between wall and recessing flanges or front cover of fully recessed unit.
- I. Install piping within pedestals for freestanding units.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in Division 23 Section "Hydronic Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Hot Water Piping: Unless otherwise indicated:
  - 1. Install union and isolation valve on supply-water connection.
  - 2. Install union and calibrated balancing valve or PICCV as indicated on the Drawings on return-water connection.
  - 3. Hydronic specialties are specified in Division 23 Section "Hydronic Piping."
- C. Install control valves as required by Division 23 Section "Temperature Controls."
- D. Install piping adjacent to convection heating units to allow service and maintenance.

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace convection heating units that do not pass tests and inspections and retest as specified above.

END OF SECTION 238233

SECTION 238240 - CENTRIFUGAL FAN CABINET UNIT HEATERS (HOT WATER)

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."

1.2 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Plans, elevations, sections, and details.
  - 2. Location and size of each field connection.
  - 3. Location and arrangement of piping valves and specialties.
  - 4. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Suspended ceiling components.
  - 2. Structural members to which cabinet unit heaters will be attached.
  - 3. Method of attaching hangers to building structure.
  - 4. Size and location of initial access modules for acoustical tile.

5. Items penetrating finished ceiling, including the following:

- a. Lighting fixtures.
- b. Air outlets and inlets.
- c. Speakers.
- d. Sprinklers.
- e. Access panels.

6. Perimeter moldings for exposed or partially exposed cabinets.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For cabinet unit heaters to include in operation and maintenance manuals.

### 1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

### 1.4 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: Furnish spare filter for each filter installed.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURED UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier Corporation; United Technologies Corporation.
2. Daikin Applied; a member of Daikin Industries, Ltd.
3. Hydro-Air Components Inc.; Rittling.
4. Modine Manufacturing Co.
5. Sterling Radiator; a Mestek Company.
6. Trane; a business of Ingersoll Rand.
7. Vulcan Radiator; a Mestek Company.

B. Description: A factory-assembled and -tested unit complying with AHRI 440.

C. Coil Section Insulation: ASTM C 1071; surfaces exposed to airstream shall have erosion-resistant coating to prevent erosion of glass fibers.

1. Thickness: Minimum 1/2 inch.
  2. Thermal Conductivity (k-Value): 0.26 Btu x in./h x sq. ft. at 75 deg F mean temperature.
  3. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
  4. Adhesive: Comply with ASTM C 916 and with NFPA 90A or NFPA 90B.
  5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Cabinet: Steel with baked-enamel finish with manufacturer's standard paint, in color selected by Architect.
1. Horizontal Unit, Exposed Bottom Panels: Minimum 0.0528-inch- thick, sheet steel, removable panels secured with tamperproof cam fasteners and safety chain.
  2. Vertical Unit, Exposed Front Panels: Minimum 0.0528-inch- thick, sheet steel, removable panels with channel-formed edges secured with tamperproof cam fasteners.
  3. Recessing Flanges for Units That Are Semirecessed or Fully Recessed: Steel, finished to match cabinet.
  4. Control Access Door: Key operated.
  5. Base for Surface, Vertical, Wall-Mounting Units: Minimum 0.0528-inch- thick steel, finished to match cabinet, 6 inches high with leveling bolts.
- E. Filters: Minimum arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
1. Glass Fiber Treated with Adhesive: Throw-away type 80 percent arrestance and 5 MERV.
- F. Hot-Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain.
- G. Fan and Motor Board: Removable.
1. Fan: Forward curved, double-width centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.
  2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Division 20 Section "Motors."
  3. Wiring Terminations: Connect motor to chassis wiring with plug connection.
- H. Electrical Connection: Factory wire motors and controls for a single field connection.
- I. Capacities and Characteristics: Refer to Schedule on Drawings.
- 2.2 UNIT CONTROLS
- A. Control devices are specified in Division 23 Section "Temperature Controls," and operational sequences are indicated on the Drawings.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas to receive cabinet unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for piping and electrical connections to verify actual locations before cabinet unit heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Install cabinet unit heaters to comply with NFPA 90A.
- B. Suspend cabinet unit heaters from structure with elastomeric hangers.
  - 1. Vibration isolators are specified in Division 20 Section "Mechanical Vibration and Controls."
- C. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.
- D. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

#### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Comply with safety requirements in UL 1995.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding."
- E. Connect wiring according to Division 26 Section "Conductors and Cables."

#### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cabinet unit heaters.

END OF SECTION 238240



SECTION 238413 - HUMIDIFIERS

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    1.2 DEFINITION .....1

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    3.4 FIELD QUALITY CONTROL .....5

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 23 Section "Steam and Condensate Piping."

1.2 DEFINITION

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.3 ACTION SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Shop Drawings: Detail fabrication and installation of humidifiers. Include piping details, plans, elevations, sections, details of components, manifolds, and attachments to other work.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
- B. Coordination Drawings: Detail humidifiers and adjacent equipment. Show support locations, type of support, weight on each support, required clearances, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Structural members to which humidifiers will be attached.
  - 2. Size and location of initial access modules for acoustical tile.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Field quality-control test reports.
- B. Operation and Maintenance Data: For humidifiers to include in operation and maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with ARI 640, "Commercial and Industrial Humidifiers."

#### 1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Supply one replacement electrode cylinder with each self-contained humidifier.

#### 1.8 COORDINATION

- A. Coordinate location and installation of humidifiers with manifolds in ducts and air-handling units or occupied space. Revise locations and elevations to suit field conditions and to ensure proper humidifier operation.

### PART 2 - PRODUCTS

## 2.1 SHORT ABSORPTION MANIFOLDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. driSteem Humidifier Company; Ultra-sorb.
  2. Armstrong International, Inc.; HumidiPack Series.
  3. Carel USA, LLC; UltimateSAM.
  4. Condair Inc.; SAM-e.
  5. Pure Humidifier Company; Insty-Pac Series.
  6. Trion IAQ; Herrmidifier.
- B. Designed for pressurized steam from an existing central plant boiler, to directly inject steam into ducted airstream for humidification.
1. Steam Dispersion Panel: Consists of horizontal steam header supplying steam to bank of closely spaced vertical or horizontal tubes as required to meet scheduled absorption distances and reduce condensation losses.
  2. Header Material: ASTM A 666, Type 304 stainless steel.
  3. Steam Inlet and Condensate Return: Located on the same side.
  4. Distribution Tube Material: Type 304 stainless steel.
    - a. Tubes include threaded standoffs for attachment to factory supplied support bracket.
  5. Stainless Steel Nozzle Inserts:
    - a. Ensure condensate free steam dispersed from center of distribution tubes.
    - b. Shall have metered orifices, sized to provide even distribution of discharged steam, and spaced for optimum steam absorption.
  6. Tubes and Headers: Shall accommodate installation of insulation.
    - a. Tube and header Insulation: For increased energy efficiency and reduced airstream heat gain.
- C. Options:
1. Adjustable mounting frame.

## 2.2 DRAIN WATER COOLER (STAINLESS STEEL)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Armstrong International, Inc.; Temp-R-Drain.
  2. Condair Inc.
  3. Pure Humidifier Company.
  4. driSteem Humidifier Company.
- B. Description: Reduces humidifier drain water temperature from 212 deg F to 140 deg F before the water enters the building plumbing system. Stainless steel cylindrical reservoir with:
1. Hot water inlet connection.

2. Blended water outlet connection.
3. Cold water inlet having a self-activated valve with temperature sensor.
4. Brass ball valve for manual drain.

### 2.3 DRAIN WATER COOLER (CAST IRON)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Armstrong International, Inc.; CC-5 and CC-12 Series Condensate Coolers.
- B. Description: Reduces humidifier drain water temperature from 212 deg F to 140 deg F before the water enters the building plumbing system. ASTM A48 cast iron cylindrical reservoir with:
  1. Hot water inlet connection.
  2. Blended water outlet connection.
  3. Cold water inlet having a self-activated valve with temperature sensor.
  4. Brass ball valve for manual drain.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine ducts, air-handling units, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before humidifier installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install humidifiers with required clearance for service and maintenance.
- B. Seal humidifier manifold duct or plenum penetrations with flange.
- C. Install humidifier manifolds in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."
- D. Install stainless-steel drain pan under each manifold mounted in duct.
  1. Construct drain pans with connection for drain; insulated.
  2. Connect to condensate trap and drainage piping.
  3. Extend drain pan upstream and downstream from manifold a minimum distance recommended by manufacturer but not less than required by ASHRAE 62.1-2004.

- E. Install manifold supply piping pitched to drain condensate back to humidifier.
- F. Install drip leg upstream from steam trap a minimum of 12 inches tall for proper operation of trap.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20, 22 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
  - 1. Install piping adjacent to humidifiers to allow service and maintenance.
  - 2. Install shutoff valve, strainer, backflow preventer, and union in humidifier makeup line.
- B. Install electrical devices and piping specialties furnished by manufacturer but not factory mounted.
- C. Install piping from safety relief valves to nearest floor drain.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding."
- E. Connect wiring according to Division 26 Section "Conductors and Cables."

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain humidifiers.

END OF SECTION 238413

SECTION 260010 - ELECTRICAL GENERAL REQUIREMENTS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.2 SUMMARY

- A. This Section includes electrical general administrative and procedural requirements. The following requirements are included in this Section to supplement the requirements specified in Division 1 Specification Sections.

- B. Mechanical and Electrical Specifications have been developed utilizing Construction Specifications Institute MasterFormat and make use of the Facilities Services Subgroup - Divisions 20-28; Site and Infrastructure Subgroup - Division 33; and Process Equipment Subgroup - Divisions 40 and 42.
- C. Division 1 Documents and Architectural Specifications in Divisions 2 through 14 have been developed in the MasterFormat 95 Edition and utilize Division 1 through Division 14.
- D. Where Division 15 Mechanical or Division 16 Electrical are referenced in Division 1 Documents, or within the Architectural Specifications in Divisions 2 through 14, they should refer to Division 20-28, 33, 40, and 42. For additional cross reference information refer to the Construction Specifications Institute.

### 1.3 REFERENCES

- A. All materials shall be new. The electrical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable Standard Specifications of the following recognized authorities:
  - 1. ANSI - American National Standards Institute; [www.ansi.org](http://www.ansi.org).
  - 2. ASTM - ASTM International; [www.astm.org](http://www.astm.org).
  - 3. CSI - Construction Specifications Institute (The); [www.csiresources.org](http://www.csiresources.org).
  - 4. ICEA - Insulated Cable Engineers Association, Inc.; [www.icea.net](http://www.icea.net).
  - 5. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); [www.ieee.org](http://www.ieee.org).
  - 6. NEC - National Electrical Code
  - 7. NECA - National Electrical Contractors Association; [www.necanet.org](http://www.necanet.org).
    - a. NECA 1-2000, "Practices for Good Workmanship in Electrical Contracting (ANSI)."
  - 8. NEMA - National Electrical Manufacturers Association; [www.nema.org](http://www.nema.org).
  - 9. NETA - InterNational Electrical Testing Association; [www.netaworld.org](http://www.netaworld.org).
  - 10. UL - Underwriters Laboratories Inc.; [www.ul.com](http://www.ul.com).

### 1.4 QUALITY ASSURANCE

- A. Scope of Work: Furnish all labor, material, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the electrical systems as specified in the Division 26 Sections and as indicated on Drawings.
  - 1. Contract Documents are complimentary, and what is required by one shall be as binding as if required by all. In the event of inconsistencies or disagreements within the Construction Documents bids shall be based on the most expensive combination of quality and quantity of the work indicated.
  - 2. The Contractor understands that the work herein described shall be complete in every detail.
- B. Ordinances and Codes: Perform all Work in accordance with applicable Federal, State and local ordinances and regulations, the Rules and Regulations of NFPA, NECA, and UL, unless otherwise indicated.

1. Notify the Architect/Engineer before submitting a proposal should any changes in Drawings or Specifications be required to conform to the above codes, rules or regulations. After entering into Contract, make all changes required to conform to above ordinances, rules and regulations without additional expense to the Owner.
- C. Source Limitations: All equipment of the same or similar systems shall be by the same manufacturer.
- D. Tests and Inspections: Perform all tests required by state, city, county and/or other agencies having jurisdiction. Provide all materials, equipment, etc., and labor required for tests.
- E. Performance Requirements: Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the trades involved.
- F. Sequence and Schedule: Work so as to avoid interference with the work of other trades. Be responsible for removing and relocating any work which in the opinion of the Owner's Representatives causes interference.

#### 1.5 CODES, PERMITS AND FEES

- A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for electrical work shall be secured and paid for by the Contractor. All work shall conform to all applicable codes, rules and regulations.
- B. Rules of local utility companies shall be complied with. Coordinate with the utility company supplying service to the installation and determine all devices including, but not limited to, all current and potential transformers, meter boxes, C.T. cabinets and meters which will be required and include the cost of all such items and all utilities costs in proposal.
- C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed Drawings or diagrams which may be required by the governing authorities. Where the Drawings and/or Specifications indicate materials or construction in excess of code requirements, the Drawings and/or Specifications shall govern.

#### 1.6 DRAWINGS

- A. The Drawings show the location and general arrangement of equipment, electrical systems and related items. They shall be followed as closely as elements of the construction will permit.
- B. Examine the Drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, conduit, junction boxes and accessories as may be required to meet such conditions.
- C. Deviations from the Drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.
- D. The architectural and structural Drawings take precedence in all matters pertaining to the building structure, mechanical Drawings in all matters pertaining to mechanical trades and electrical Drawings in all matters pertaining to electrical trades. Where



there are conflicts or differences between the Drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.

- E. Drawings are not intended to be scaled for rough-in or to serve as shop drawings. Take all field measurements required to complete the Work.

#### 1.7 MATERIAL AND EQUIPMENT MANUFACTURERS

- A. All items of equipment shall be furnished complete with all accessories normally supplied with the catalog items listed and all other accessories necessary for a complete and satisfactory operating system. All equipment and materials shall be new and shall be standard products of manufacturers regularly engaged in the production of electrical equipment and shall be of the manufacturer's latest design.
- B. If an approved manufacturer is other than the manufacturer used as the basis for design, the equipment or product provided shall be equal in size, quality, durability, appearance, capacity, and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system and shall comply with the requirements for Items Requiring Prior Approval specified in this section of the Specifications. All costs to make these items of equipment comply with these requirements including, but not limited to, electrical work, and building alterations shall be included in the original Bid. Similar equipment shall be by one manufacturer.
- C. Where existing equipment is modified to include new switches, circuit breakers, metering or other components, the new components shall be by the original equipment manufacturer and shall be listed for installation in the existing equipment. Where original equipment manufacturer components are not available, third party aftermarket components shall be listed for the application and submitted to the engineer for approval. Reconditioned or salvaged components shall not be used unless specifically indicated on the drawings.

#### 1.8 INSPECTION OF SITE

- A. Visit the site, examine and verify the conditions under which the Work must be conducted before submitting Proposal. The submitting of a Proposal implies that the Contractor has visited the site and understands the conditions under which the Work must be conducted. No additional charges will be allowed because of failure to make this examination or to include all materials and labor to complete the Work.

#### 1.9 ITEMS REQUIRING PRIOR APPROVAL

- A. Bids shall be based upon manufactured equipment specified. All items that the Contractor proposes to use in the Work that are not specifically named in the Contract Documents must be submitted for review prior to bids. Such items must be submitted in compliance with Division 1 specifications. Requests for prior approval must be accompanied by complete catalog information, including but not limited to, model, size, accessories, complete electrical information and performance data in the form given in the equipment schedule on the drawings at stated design conditions. Where items are referred to by symbolic designations on the drawings, all requests for prior approval shall bear the same designations.

1. Equipment to be considered for prior approval shall be equal in quality, durability, appearance, capacity and efficiency through all ranges of operation, shall fulfill the requirements of equipment arrangement and space limitations of the equipment shown on the plans and/or specified and shall be compatible with the other components of the system.
2. All costs incurred to make equipment comply with other requirements, including providing maintenance, clearance, electrical, replacement of other components, and building alterations shall be included in the original bid.

- B. Voluntary alternates may be submitted for consideration, with listed addition or deduction to the bid.

#### 1.10 SHOP DRAWINGS/SUBMITTALS

- A. Submit project-specific submittals for review in compliance with Division 1.
- B. All shop Drawings shall be submitted in groupings of similar and/or related items (lighting fixtures, switchgear, etc.). Incomplete submittal groupings will be returned unchecked.
- C. Provide detailed layout shop Drawings on electronic media of all lighting and power distribution systems, routing of conduits, combining of circuits, circuiting, details and related information necessary of installation and maintenance. After review by the Architect/Engineer, an electronic Drawings will be stamped and returned to the Contractor.
- D. If deviations (not substitutions) from Contract Documents are deemed necessary by the Contractor, details of such deviations, including changes in related portions of the project and the reasons therefore, shall be submitted with the submittal for approval.
- E. Submit for approval shop drawings for electrical systems or equipment indicated in other sections of electrical specs. Where items are referred to by symbolic designation on the Drawings and Specifications, all submittals shall bear the same designation (light fixtures).

#### 1.11 COORDINATION DRAWINGS

- A. Submit project specific coordination drawings for review in compliance with Division 1 Specification Sections.

#### 1.12 OPERATION AND MAINTENANCE INSTRUCTIONAL MANUALS

- A. Submit project specific Operation and Maintenance Instructional Manuals for review in compliance with Division 01 Specification Sections.
- B. Provide complete operation and maintenance instructional manuals covering all electrical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Manual shall be provided on electronic media. All literature shall be combined in one document and shall be properly bookmarked with all applicable sections. Maintenance and operating instructional manuals shall be provided when construction is approximately 75% complete.

- C. The operating and maintenance instructions shall include a brief, general description for all electrical systems including, but not limited to:
  - 1. Routine maintenance procedures.
  - 2. Trouble-shooting procedures.
  - 3. Contractor's telephone numbers for warranty repair service.
  - 4. Submittals.
  - 5. Recommended spare parts list.
  - 6. Names and telephone numbers of major material suppliers and subcontractors.
  - 7. System schematic drawings on 8-1/2" x 11" sheets.

#### 1.13 RECORD DRAWINGS

- A. Submit record drawings in compliance with Division 01.
- B. Contractor shall submit to the Architect/Engineer, record drawings on electronic media which have been neatly marked to represent as-built conditions for all new electrical work. Modifications to original drawings shall be clearly marked with a contrasting color so the marks are readily apparent.
- C. The Contractor shall keep accurate note of all deviations from the construction documents and discrepancies in the underground concealed conditions and other items of construction on field drawings as they occur. The marked up field documents shall be available for review by the Architect, Engineer and Owner at their request during the course of construction.

#### 1.14 INSTRUCTION OF OWNER PERSONNEL

- A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of electrical equipment and systems at agreed upon times. A minimum of 8 hours of formal instruction to Owner's personnel shall be provided for each building. Additional hours are specified in individual specification sections.
- B. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- C. In addition to individual equipment training provide overview of each electrical system. Utilize the as-built documents for this overview.
- D. Prepare and insert additional data in operation and maintenance manual when need for such data becomes apparent during instruction, or as requested by Owner.

#### 1.15 WARRANTY

- A. Warranty: Comply with the requirements in Division 01 Specification Sections. Contractor shall warranty that the electrical installation is free from defects and agrees to replace or repair, to the Owner's satisfaction, any part of this electrical installation which becomes defective within a period of one year (unless specified otherwise in other Division 26 sections) from the date of substantial completion following final acceptance, provided that such failure is due to defects in the equipment, material, workmanship or failure to follow the contract documents.

- B. Contractor shall be responsible for any temporary services including equipment and installation required to maintain operation as a result of any equipment failure or defect during warranty period.
- C. File with the Owner any and all warranties from the equipment manufacturers including the operating conditions and performance capacities they are based on.

#### 1.16 USE OF EQUIPMENT

- A. The use of any equipment, or any part thereof for purposes other than testing even with the Owner's consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor be construed to obligate the Owner in any way to accept improper work or defective materials.
- B. Do not use Owner's lamps for temporary lighting except as allowed and directed by the Owner. Equip lighting fixtures with new lamps when the project is turned over to the Owner.

#### 1.17 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
  - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  - 3. To allow right of way for piping and conduit installed at required slope.
  - 4. To ensure that connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions; and to maintain the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."
- D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

### PART 2 - PRODUCTS (NOT APPLICABLE)

### PART 3 - EXECUTION

#### 3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.

- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to raceways and piping systems installed at a required slope.

### 3.2 DEMOLITION WORK

- A. All demolition of existing electrical equipment and materials will be done by this Contractor unless otherwise indicated. Include all items such as, but not limited to, electrical equipment, devices, lighting fixtures, conduit, and wiring called out on the Drawings and as necessary whether such items are actually indicated on the Drawings or not in order to accomplish the installation of the specified new work.
- B. In general, demolition work is indicated on the Drawings. However, the Contractor shall visit the job site to determine the full extent and character of this work.
- C. Unless specifically noted to the contrary, removed materials shall not be reused in the work. Salvaged materials that are to be reused shall be stored safe against damage and turned over to the appropriate trade for reuse. Salvaged materials of value that are not to be reused shall remain the property of the Owner unless such ownership is waived. Items on which the Owner waives ownership shall become the property of the Contractor, who shall remove and legally dispose of same, away from the premises.
- D. Where equipment or fixtures are removed, outlets shall be properly blanked off, and conduits capped. After alterations are done, the entire installation shall present a "finished" look, as approved by the Architect/Engineer. The original function of the present electrical work to be modified shall not be changed unless required by the specific revisions to the system as specified or as indicated.
- E. Reroute signal wires, lighting and power wiring as required to maintain service. Where walls and ceilings are to be removed as shown on the Drawings, the conduit is to be cut off by the Electrical Trades so that the abandoned conduit in these walls and ceilings may be removed with the walls and ceilings by the Architectural Trades. All dead-end conduit runs shall be plugged at the remaining line outlet boxes or at the panels.
- F. Where new walls and/or floors are installed which interfere with existing outlets, devices, etc., the Electrical Trades shall adjust, extend and reconnect such items as required to maintain continuity of same.
- G. All electrical work in altered and unaltered areas shall be run concealed wherever possible. Use of surface raceway or exposed conduits will be permitted only where approved by the Architect/Engineer.
- H. Existing lighting shall be reused where indicated on plans. Reused fixtures shall be detergent cleaned, relamped and reconditioned suitable for satisfactory operation and appearance.

### 3.3 INSTALLATION OF EQUIPMENT

- A. Install all equipment in strict accordance with all directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the Drawings and Specifications, report such conflicts to the Architect/Engineer for resolution.
- B. Device Location:
  - 1. Allow for relocation prior to installation of wiring devices and other control devices, for example, receptacles, switches, fire alarm devices, and access control devices, within a 10-foot radius of indicated location without additional cost.

### 3.4 WORK IN EXISTING BUILDINGS

- A. The Owner will provide access to existing buildings as required. Access requirements to occupied buildings shall be identified on the project schedule. The Contractor, once Work is started in the existing building, shall complete same without interruption so as to return work areas as soon as possible to Owner.
- B. Adequately protect and preserve all existing and newly installed Work. Promptly repair any damage to same at Contractor's expense.
- C. Consult with the Owner's Representative as to the methods of carrying on the Work so as not to interfere with the Owner's operation any more than absolutely necessary. Accordingly, all service lines shall be kept in operation as long as possible and the services shall only be interrupted at such time as will be designated by the Owner's Representative.
- D. Prior to starting work in any area, obtain approval for doing so from a qualified representative of the Owner who is designated and authorized by the Owner to perform testing and abatement of all hazardous materials including but not limited to, asbestos. The Contractor shall not perform any inspection, testing, containment, removal or other work that is related in any way whatsoever to hazardous materials under the Contract.

### 3.5 TEMPORARY SERVICES

- A. Provide and remove upon completion of the project, in accordance with the general conditions and as described in Division 01, a complete temporary electrical and telephone service during construction.

### 3.6 DISPOSAL

- A. Fluorescent Lamps
  - 1. Fluorescent lamps are known to contain mercury and are classified as hazardous material. All fluorescent lamps shall be assumed to contain mercury unless tested and confirmed otherwise with a toxicity characteristic leaching procedure (TCLP).
  - 2. Hazardous materials (fluorescent lamps), shall be sent to a lamp recycling facility. The materials shall be properly packaged with labels that meet the

Department of Transportation Regulations and stored in a secure location prior to transportation.

3. The Contractor shall identify the costs of the lamp disposal process including, but not limited to, the lamp packaging, storage, transportation, disposal, and any profile fees.
4. At the completion of the project, provide documentation to verify that the lamps have been properly disposed of in accordance with all local, state and federal guidelines.

B. Ballasts

1. Lighting ballasts manufactured prior to 1979 have been known to contain polychlorinated biphenyls (PCBs). Unless specifically noted on the ballast as containing "No PCBs," the ballast shall be assumed to contain components with PCB materials.
2. Hazardous materials (ballasts with PCBs), shall be disposed of at a hazardous waste incineration facility, or at a recycling facility in accordance with the Code of Federal Regulations as administered by the EPA in regards to this issue. The ballasts shall be packaged/stored in fifty-five gallon steel drums with labels that meet the Department of Transportation Regulations.
3. The Contractor shall identify the costs of the ballast disposal process including, but not limited to, the packaging, storage, transportation, disposal, and any profile fees.
4. Provide at completion of the project documentation (manifests) to verify that the ballasts have properly been disposed of in accordance with all local, state and federal guidelines.

3.7 CHASES AND RECESSES

- A. Provided by the architectural trades, but the Contractor shall be responsible for their accurate location and size.

3.8 CUTTING, PATCHING AND DAMAGE TO OTHER WORK

- A. Refer to General Conditions for requirements.
- B. All cutting, patching and repair work shall be performed by the Contractor through approved, qualified subcontractors. Contractor shall include full cost of same in bid.

3.9 EXCAVATION AND BACKFILLING

- A. Provide all excavation, trenching, tunneling, dewatering and backfilling required for the electrical work. Coordinate the work with other excavating and backfilling in the same area.
- B. Where conduit is installed less than 2'6" below the surface of pavement, provide concrete encasement, 4" minimum coverage, all around or as shown on the electrical Drawings.
- C. Backfill all excavations with well-tamped granular material. Backfill all excavations under wall footings with lean mix concrete up to underside of footings and extend concrete within excavation a minimum of four (4) feet each side of footing. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent

compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.

- D. Backfill all excavations inside building, under drives and parking areas with well-tamped granular material. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.
- E. Backfill outside building with granular material to a height 12 inches over top of pipe compacted to 95 percent compaction as specified above. Backfill remainder of excavation with unfrozen, excavated material in such a way to prevent settling.

### 3.10 EQUIPMENT CONNECTIONS

- A. Make connections to equipment and other items included in the work in accordance with the approved shop Drawings and rough-in measurements furnished by the manufacturers of the particular equipment furnished. All additional connections not shown on the Drawings, but called out by the equipment manufacturer's shop Drawings shall be provided.

### 3.11 CLEANING

- A. All debris shall be removed daily as required to maintain the work area in a neat, orderly condition.
- B. Final cleanup shall include, but not be limited to, washing of fixture lenses or louvers, switchboards, substations, motor control centers, panels, etc. Fixture reflectors and lenses or louvers shall be left with no water marks or cleaning streaks.

### 3.12 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS

- A. Equipment and materials shall be protected from theft, injury or damage.
- B. Protect conduit openings with temporary plugs or caps.
- C. Provide adequate storage for all equipment and materials delivered to the job site. Location of the space will be designated by the Owner's representative or Architect/Engineer. Equipment set in place in unprotected areas must be provided with temporary protection.

### 3.13 EXTRA WORK

- A. For any extra electrical work which may be proposed, this Contractor shall furnish to the General Contractor, an itemized breakdown of the estimated cost of the materials and labor required to complete this work. The Contractor shall proceed only after receiving a written order from the General Contractor establishing the agreed price and describing the work to be done. Prior to any extra work which may be proposed, the Electrical Contractor shall submit unit prices (same prices for increase/decrease of work) for the following items: 1/2", 3/4", 1", 1-1/2" conduit; #12, #10, #8, #6, #2 wire; receptacle, data box, fire alarm combination visual/audible notification appliance, fire alarm visual notification appliance, clock, or other devices which may be required for any proposed extra work.



3.14 DRAWINGS AND MEASUREMENTS

- A. The Drawings are not intended to be scaled for rough-in measurements nor to serve as Shop Drawings. Field measurements necessary for ordering materials and fitting the installation to the building construction and arrangement are the Contractor's responsibility. The Contractor shall check latest Architectural Drawings and locate light switches from same where door swings are different from Electrical Drawings.

END OF SECTION 260010

SECTION 260519 - CONDUCTORS AND CABLES

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes:

- 1. Building wires and cables rated 600V and less.
- 2. Connectors, splices, and terminations rated 600 V and less.

1.3 SUBMITTALS

- A. Field Quality-Control Test Reports
- B. Submit letter of compliance (intent) for general building wire and cable. Provide product data for the following:
  - 1. Metal-Clad Cable, Type MC
  - 2. Power Cable for Variable Frequency Controlled Motors

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

### PART 2 - PRODUCTS

#### 2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Standards:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  - 2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- D. Conductor Insulation:
  - 1. Type THHN/THWN-2: Comply with UL 83.
  - 2. Type THW/THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
  - 3. Type XHHW-2: Comply with UL 44.

#### 2.2 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Manufacturers:
  - 1. AFC Cable Systems
  - 2. Alpha Wire Company
  - 3. American Bare Conductor
  - 4. Belden
  - 5. Encore
  - 6. General Cable
  - 7. Okonite
  - 8. Service Wire Co.
  - 9. Southwire Company
- C. Standards:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  - 2. Comply with UL 1569.

3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit and multi-circuit with color-coded conductors for branch circuit distribution.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

E. Conductors:

1. Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
2. Aluminum, complying with ASTM B 800 and ASTM B 801 for conductors #1 AWG and larger.

- F. Ground Conductor: Insulated. Ground conductor sized as indicated on drawings (reduced ground conductor is not acceptable).

G. Conductor Insulation:

1. Type TFN/THHN/THWN-2: Comply with UL 83.
2. Type XHHW-2: Comply with UL 44.

- H. Armor: Steel OR Aluminum, interlocked.

### 2.3 POWER CABLE FOR VARIABLE FREQUENCY CONTROLLED MOTORS

- A. Description: A factory assembly of three conductor cable with three symmetrical ground conductors, a continuous shield and overall PVC jacket.

B. Manufacturers:

1. Southwire Armor-x
2. Belden
3. Draka

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1277
3. Comply with ICEA S-95-658/NEMA WC 70 for Type TC-ER Power Cable (for VFD application)
4. Comply with NEMA WC 61
5. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit feeder.

- E. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

- F. Ground Conductor: Bare copper.
- G. Conductor Insulation: Type XLPE. Comply with UL 83. 600V and 2000V as required by the application.
- H. Shield: Dual spiral copper tape shields for 100% coverage.
  - 1. Shield transfer impedance shall be less than 10 ohms per meter up to 30 MHz when tested in accordance with NEMA WC 61
- I. Armor: Steel OR Aluminum, interlocked.
- J. Jacket: Oil resistant PVC

## 2.4 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Refer to application schedule on the drawings
- B. Feeders and Branch Circuits: Solid or stranded for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- C. Each feeder shall be of the same conductor and insulation material (phase, neutral, and parallel).
- D. Use conductor not smaller than 14 AWG for control circuits,
- E. Where equipment is listed for use with copper conductors only, use copper conductors for the entire length of feeder.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Refer to application schedule on the drawings
- B. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel wire-mesh strain relief device at terminations to suit application.
- C. Fire Alarm Circuits: Type THHN/THWN-2, in raceway.
- D. Class 1 Control Circuits: Type THHN/THWN-2, in raceway.
- E. Class 2 Control Circuits: Type THHN/THWN-2, in raceway.

- F. Connection between Variable Frequency Controllers and Motors: Use 2000V rated VFC power cable. Support 5' on center, minimum. Terminate according to cable manufacturer's recommendations.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.
- H. Support communication cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.
- I. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- J. Provide a separate neutral conductor for each circuit unless multi-wire branch circuits are specifically indicated on the drawings.
- K. Electrical Contractor shall be responsible for de-rating of conductors as required by N.E.C. when more than three current carrying conductors are installed in a single raceway or cable. Neutral conductors shall be considered current carrying conductors.
- L. Type MC cable shall be supported and secured at intervals not exceeding 4'-0" in new construction
- M. MC cable shall not be used for home runs to receptacle or distribution panels.
- N. Where MC cable is permitted by the specifications, MC cable shall not be bundled.
- O. Between support, hangers and termination no more than 3" deflection from the bottom of the cable to a horizontal line between the support/hanger or termination.
- P. Do not route conductors across roof without prior approval from engineer.

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.
  - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
  - 2. Use compression type terminations for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
- D. Clean conductor surfaces before installing lugs and connectors.
- E. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- F. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and larger.
- G. Use piercing connector with insulating covers for conductor splices and taps, 8 AWG and larger only for taps to existing feeders. Do not use piercing connectors in new construction.
- H. Use Sta-Kon connectors to terminate stranded conductors #10 AWG and smaller to screw terminals.
- I. Use insulated spring wire connectors with plastic caps (wire nuts) for copper conductor splices and taps, 10 AWG and smaller. Push-in style connectors are not permitted.
- J. Provide lugs suitable for bussing and conductor material used.

### 3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

### 3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260533 "Raceways and Boxes."

### 3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping".

### 3.8 FIELD QUALITY CONTROL

- A. Perform the following field quality control tests in accordance with Division 26 section "Electrical Testing"

- 1. Description: Test all feeders rated 100 A and above.
- 2. Visual and Mechanical Inspection
  - a. Inspect cables for physical damage and proper connection in accordance with the one line diagram.
  - b. Test cable mechanical connections with an infrared survey.
  - c. Check cable color-coding against project Specifications and N.E.C. requirements.
- 3. Electrical Tests
  - a. Perform insulation resistance test on each conductor with respect to ground and adjacent conductors. Applied potential to be 1000 volts dc for 1 minute.
  - b. Perform continuity test to insure proper cable connection.
- 4. Test Values
  - a. Minimum insulation resistance values shall be not less than fifty mega-ohms.

- B. Test Reports: Prepare a written report to record the following:

- 1. Test procedures used.
- 2. Test results that comply with requirements.
- 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519



SECTION 260526 - GROUNDING AND BONDING

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.
- B. Related Sections include the following:
  - 1. Division 26 Section "Electrical General Requirements".
  - 2. Division 26 Section "Conductors and Cables".

1.3 REFERENCES

- A. ASTM B 3: Specification for Soft or Annealed Copper Wire.
- B. ASTM B 8: Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.
- C. ASTM B 33: Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes.
- D. ASTM B 187: Specification for Copper, Bus Bar, Rod, and Shapes and General Purpose Rod, Bar, and Shapes.

- E. IEEE 81: Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
- F. IEEE 142: Grounding of Industrial and Commercial Power Systems.
- G. IEEE 837: Qualifying Permanent Connections Used in Substation Grounding.
- H. IEEE 1100 - 1992: Recommended Practice for Powering and Grounding Sensitive Electronic Equipment.
- I. IEEE C2: National Electrical Safety Code.
- J. NETA MTS - 2001: Maintenance Testing Specifications.
- K. NFPA 70: National Electrical Code.
- L. NFPA 70B: Recommended Practice for Electrical Equipment Maintenance.
- M. NFPA 99: Health Care Facilities.
- N. NFPA 780: Lightning Protection Code.
- O. TIA/EIA 607: Commercial Building Grounding and Bonding Requirements Standard.
- P. UL 96: Lightning Protection Components.
- Q. UL 467: Grounding and Bonding Equipment.
- R. UL 486 A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- S. UL 486B: Wire Connectors for Use with Aluminum Conductors.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Data: For the following:
  - 1. Ground rods.
  - 2. Compression-type connectors.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- D. Field Test Reports: Submit written test reports to include the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
  - 4. Indicate overall system resistance to ground.
  - 5. Indicate overall Telecommunications system resistance to ground.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 26 "Electrical General Requirements".
- B. Accurately record actual locations of grounding electrodes and connections to building steel.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Refer to specification section "Electrical Testing."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - 1. Comply with UL 467.
- C. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.
- D. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.
- E. Comply with ANSI/TIA/EIA-607 "Standard for Commercial Building Grounding and Bonding Requirements for Telecommunications".
- F. Comply with ANSI/IEEE 1100 -1992 "Powering and Grounding Sensitive Electronic Equipment".

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Grounding Conductors and Cables:
    - a. Refer to Division 26 Section "Conductors and Cables".
  - 2. Grounding Rods:
    - a. American Electric-Blackburn.
    - b. Apache Grounding/Erico Inc.
    - c. Chance/Hubbell.
  - 3. Mechanical Connectors:
    - a. American Electric-Blackburn.
    - b. Burndy.
    - c. Chance/Hubbell.
  - 4. Exothermic Connections:

- a. Cadweld.
- 5. Compression-type Connectors:
  - a. Burndy HyGround
  - b. Blackburn EZ Ground.
  - c. Panduit.

## 2.2 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26 Section "Conductors and Cables."
- B. Material: copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Grounding Electrode Conductors: Stranded cable.
- E. Underground Conductors: Bare, tinned, stranded, copper unless otherwise indicated.
- F. Bare Copper Conductors: Comply with the following:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Assembly of Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
- G. Copper Bonding Conductors: As follows:
  - 1. Bonding Conductor: Stranded copper conductor; size per the NEC.
  - 2. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; size per the NEC.
  - 3. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; size per the NEC.
- H. Ground Conductor and Conductor Protector for Wood Poles: As follows:
  - 1. No. 4 AWG minimum, soft-drawn copper conductor.
  - 2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir, or cypress or cedar.
- I. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

## 2.3 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected for the specific application per manufacturer's written instructions.
- D. Compression-Type Connectors: Pure, wrought copper, per ASTM B187.

## 2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel.
  - 1. Size: 5/8 in diameter.
  - 2. Length: 120 inches.
- B. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Provide handholes as specified in Division 2 Section "Underground Ducts and Utility Structures."

## PART 3 - EXECUTION

### 3.1 EQUIPMENT GROUNDING

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- C. Underground Grounding Conductors: No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.
- D. In raceways, use insulated equipment grounding conductors.
- E. Install equipment grounding conductors in all feeders and circuits. Terminate each end on suitable lugs, bus or bushing.
- F. Busway Supply Circuits: Install insulated equipment grounding conductor from the grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- G. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.
- H. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
- I. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.
- J. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
- K. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a separate equipment grounding conductor with supply branch-circuit conductors. Bond pole and foundation reinforcing steel to equipment ground conductor.

- L. Verify specific equipment grounding requirements with the manufacturer's recommendations.

### 3.2 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.
  - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
  - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations
  - 1. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and larger.
  - 2. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.
- F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A or UL 486B as applicable.
- G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Connections shall be non-reversible. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- H. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

### 3.3 INSTALLATION

- A. Equipotential Ground: Interconnect grounding electrodes to form one, electrically continuous, equipotential grounding electrode system. Grounding electrodes to be interconnected include:
  - 1. Ground rods.
  - 2. Metal water service pipe.
- B. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
  - 1. Verify that final backfill and compaction has been complete before driving ground rods.
  - 2. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
  - 3. Interconnect ground rods with grounding electrode conductors. Use exothermic welds or non-reversing compression-type connectors, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
- C. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Install in conduit where routed above grade.
  - 1. Aluminum and copper-clad aluminum conductors shall not be used in direct contact with masonry, within 18 inches of the earth, or where subject to corrosive conditions.
- D. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors or non-reversing compression-type connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- E. Metal Water Service Pipes in direct contact with the earth for 10 feet: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to all metal water service entrances to building including fire protection water service entrance. Connect grounding conductors to metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- F. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.
- G. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.
- H. Bond interior metal piping systems, including any portions of metal piping systems separated by non-metal piping, and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

- I. Separately Derived AC Power Systems: Ground separately-derived ac power system neutrals including distribution transformers and uninterruptible power supplies to grounding electrodes per NFPA 70.
- J. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.
- K. Grounding Bus:
  - 1. Install grounding bus in the locations listed below and elsewhere as indicated:
    - a. Electrical equipment rooms.
    - b. Telephone equipment rooms.
    - c. Rooms housing service equipment.
  - 2. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.
- L. Equipment Grounding: Provide a permanent and continuous bonding of conductor enclosures, equipment frames, power distribution equipment ground busses, cable trays, metallic raceways, and other non-current carrying metallic parts of the electrical system.
- M. Bond together metal building elements not attached to grounded structure; bond to ground.
- N. Provide a flexible braid bonding jumper at each set of columns at expansion joints.

### 3.4 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality control tests in accordance with Division 26 section "Electrical Testing"
  - 1. Inspect grounding and bonding system conductors and connections for tightness and proper installation and for compliance with the Drawings and Specifications.
  - 2. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
    - a. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.
    - b. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    - c. Perform ground-impedance measurements utilizing either the intersecting curves method or the slope method. (Ref. Nos. 40 and 41 in IEEE Std. 81).
    - d. Equipment Grounds: Utilize two-point method of IEEE 81. Measure between equipment ground being testing and known low-impedance grounding electrode or system.



3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
  - a. Equipment Rated 500 kVA and Less: 10 ohms.
  - b. Equipment Rated 500 to 1000 kVA: 5 ohms.
  - c. Equipment Rated More Than 1000 kVA: 3 ohms.
  - d. Substations and Pad-Mounted Switching Equipment: 5 ohms.
  - e. Manhole Grounds: 10 ohms.
  - f. The telecommunications grounding system shall have a maximum resistance of 1 ohm as measured from the TMGB ground to earth ground.
4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

### 3.5 GRADING AND PLANTING

- A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2 Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.
- B. Related Sections include the following:

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

#### 1.5 SUBMITTALS

- A. Product Data: For the following:
  - 1. Steel slotted support systems.
  - 2. Nonmetallic slotted support systems.

#### 1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

#### 1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

### PART 2 - PRODUCTS

#### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit; a part of Atkore International.
    - b. B-Line, by Eaton.
    - c. GS Metals Corp.

- d. Pentair Electrical & Fastening Solutions.
  - e. Thomas & Betts Corporation.
  - f. Unistrut; a part of Atkore International.
  - g. Wesanco, Inc.
2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  4. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch-diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit; a part of Atkore International.
    - b. B-Line by Eaton.
    - c. Fabco Plastics Wholesale Limited.
    - d. Seasafe, Inc.
  2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
  3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
  4. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) B-Line by Eaton.
      - 2) Empire Tool and Manufacturing Co., Inc.
      - 3) Hilti Inc.
      - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

5) MKT Fastening, LLC.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

2.3 ROOF MOUNTED CONDUIT AND EQUIPMENT SUPPORTS

- A. General: Shop- or field- fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted conduit and equipment.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. B-Line by Eaton; Dura-Blok.
  2. MIRO Industries.
  3. Pentair Electrical & Fastening Solutions; Caddy Pyramid.
  4. Pipe Pier Support Systems; Pipe Piers.
- C. Adjustable Compact Stand: Recycled rubber base unit with integral threaded coupling capable of accepting 3/8-16 threaded rod, or 1-5/8 inch by 1-5/8 inch metal strut and various supporting elements.
- D. Multiple-Conduit and Equipment Stand: Assembly of bases, vertical and horizontal members, and conduit supports, for roof installation without membrane penetration.
  1. Bases: One or more adjustable compact stand bases.
  2. Vertical Members: Two or more protective-coated-steel channels.
  3. Horizontal Member: Protective-coated-steel channel.
  4. Supports: Standard strut clamps, hangers, and accessories.

2.4 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Division 6 Section "Rough Carpentry." Plywood sheets shall be free of all voids. Plywood shall have a minimum of two coats of fire-resistant, non-conducting paint applied to all sides of all sheets. Provide flush hardware and supports to mount plywood to wall. The provided hardware shall have sufficient strength to carry all anticipated loads including, but not limited to cabling, cable management and equipment racks.

### PART 3 - EXECUTION

#### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70 or as scheduled in NECA 1. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with:
    - a. Two-bolt conduit clamps
    - b. Single-bolt conduit clamps
    - c. Single-bolt conduit clamps using spring friction action for retention in support channel.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.
- E. Support single runs of MC cable using spring-steel clamps from suspended ceiling hangers, hanger wire or building structure at intervals not to exceed three feet. Do not support MC cable from ceiling grid.

#### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.

5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  6. To Steel:
    - a. Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
    - b. Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69
    - c. Spring-tension clamps.
  7. To Light Steel: Sheet metal screws.
  8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel support systems attached to substrate.
- E. Slotted support systems applications:
1. Indoor dry and damp Locations: Painted Steel
  2. Outdoors and interior wet locations: Galvanized Steel
- F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
- G. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- H. Obtain permission from Architect/Engineer before drilling or cutting structural members.
- I. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- J. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- K. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch off wall.
- L. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- M. The Contractor shall replace all supports and channels that sag, twist, and/or show signs of not providing proper structural support, to the equipment, it is intended for, as determined by the Owner and Architect/Engineer. All costs associated with replacing supports and steel channels shall be incurred by the Contractor.
- ### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS
- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
  - B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 INSTALLATION OF ROOF MOUNTED SUPPORTS

- A. Install in accordance with manufacturer's instructions.
- B. If gravel top roof, gravel must be removed around and under support.
- C. Consult roofing manufacturer for roof membrane compression capacities. If required, a compatible sheet of roofing material (rubber pad) may be required under rooftop support to disperse concentrated loads and add further membrane protection.
- D. Utilize properly sized clamps and accessories to suit conduit sizes.
- E. Provide vertical steel channel members as required for elevated conduit supports where required for clearances, coordination with other roof mounted systems or derating.

### 3.5 CONCRETE BASES

- A. Provide concrete bases for all floor mounted electrical equipment.
- B. Provide concrete bases for all exterior, grade level electrical equipment, and where indicated.
- C. Base/Pad Construction:
  - 1. Construct per manufacturer's recommendations for particular equipment, including suggested piers and dowel rods.
  - 2. Interior concrete bases shall have a minimum depth of 4" unless other indicated or recommended by the manufacturer.
  - 3. Exterior concrete bases shall have a minimum depth of 8" unless other indicated or recommended by the manufacturer.
  - 4. Construct concrete bases for primary and secondary power distribution equipment per requirements of the electrical utility, where submitted for its review.
- D. Anchor equipment to base per both supports and equipment manufacturer's instructions.
- E. Coordinate conduit openings and sleeve locations in base with requirements of equipment to be supported.
  - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of the base.
  - 2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.



### 3.6 BACKBOARDS

- A. A minimum of two walls (or as indicated on drawings) shall be covered with plywood backboards to a minimum 8'-6" above finished floor in all Telecommunication Rooms and similar spaces and as indicated on Drawings.
- B. Securely fasten backboard to wall using appropriate hardware and mount at all four corners, minimum. Securely fasten backboard to wall-framing members (studs).
- C. Provide adequate backboard space to allow a clean and workable arrangement for telephone and data connections.

### 3.7 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
  - 1. Division 26 Section, "Underground Ducts and Raceways for Electrical Systems" for exterior duct banks, manholes and underground utility construction.
  - 2. Division 07 Section, "Penetration Firestopping" for firestopping materials and installation at penetrations through walls, ceilings, and other fire-rated elements.

3. Division 26 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings, and for access floor boxes and service poles.
4. Division 26 "Hangers and Supports for Electrical Systems" for concrete bases.

### 1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. LFNC: Liquidtight flexible nonmetallic conduit.
- G. RNC: Rigid nonmetallic conduit.
- H. PVC: Polyvinyl Chloride.
- I. HDPE: High Density Polyethylene.
- J. RTRC: Reinforced Thermosetting Resin Conduit

### 1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

### 1.6 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

## PART 2 - PRODUCTS

### 2.1 METAL CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
  2. Alflex Inc.
  3. Allied Tube Triangle Century.
  4. Anamet Electrical, Inc.; Anaconda Metal Hose.
  5. International Metal Hose.
  6. Electri-Flex Co
  7. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
  8. LTV Steel Tubular Products Company – Manhattan/CDT/Cole-Flex.
  9. Maverick.
  10. O-Z Gedney; unit of General Signal.
  11. Wheatland.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. IMC: ANSI C80.6.
- D. EMT: ANSI C80.3.
- E. FMC: Zinc-coated steel or Aluminum.
- F. LFMC: Flexible steel conduit with PVC jacket.
- G. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
  2. Fittings for EMT: Steel, compression type.
  3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

### 2.2 FIRE ALARM EMT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Allied Tube Triangle Century.
- B. EMT conduit with bright red topcoat; Fire Alarm EMT.
- C. EMT and Fittings: ANSI C80.3.

### 2.3 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American International.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corp.
4. Cantex Inc.
5. Certainteed Corp.; Pipe and Plastics Group.
6. Condux International.
7. ElecSys, Inc.
8. Electri-Flex Co.
9. Integral.
10. Kor-Kap.
11. Lamson and Sessions: Carlon Electrical Products.
12. Manhattan/CDT/Cole-Flex.
13. RACO; Division of Hubbell, Inc.
14. Scepter.
15. Spiralduct, Inc./AFC Cable Systems, Inc.
16. Thomas & Betts Corporation.

- B. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.
- C. RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.
- D. RTRC: Comply with UL 2515A and NEMA TC 14.

#### 2.4 METAL WIREWAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hoffman.
  2. Square D.
- B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 1.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
- E. Wireway Covers: Flanged-and-gasketed type.
- F. Finish: Manufacturer's standard enamel finish.

#### 2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1. Shall be used within walls or ceiling.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover. Shall be used in all exposed, non-recessed, locations.
- C. Nonmetallic Outlet and Device Boxes: NEMA OS 2. Shall be used in corrosive areas.

- D. Floor Boxes: Refer to floor box schedule.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover. Shall be used in areas exposed to water.
- G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- H. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

## 2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. Description: Comply with ANSI/SCTE 77.
  - 1. Color of Frame and Cover: Green.
  - 2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
  - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
  - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  - 5. Cover Legend: Molded lettering, "ELECTRIC", "COMMUNICATIONS" or as indicated for each system service.
  - 6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
  - 7. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hubbell: Quazite
    - b. Armorcast Products Company.
    - c. Carson Industries LLC.
    - d. CDR Systems Corporation.
    - e. NewBasis.
    - f. Christy Concrete Products.

## 2.7 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

## 2.8 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Advance Products & Systems, Inc.
  - 2. Calpico, Inc.
  - 3. Metraflex Co.
  - 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
  - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 2. Pressure Plates: Carbon steel. Include two for each sealing element.
  - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.9 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## 2.10 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
  - 1. Tests of materials shall be performed by a independent testing agency.
  - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
  - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. Provide raceways in interior and exterior locations in accordance with the "Raceway Application Matrix" included on the drawings.
- B. Boxes and Enclosures, Exterior Aboveground: NEMA 250, Type 4X.
- C. Boxes, Enclosures, and Handholes:
  - 1. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Non-deliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
  - 2. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Non-deliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
- D. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
- E. Minimum Raceway Size: 3/4-inch trade size.
- F. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
  - 2. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
  - 3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- G. Install surface raceways only where indicated on Drawings.
- H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

### 3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Install temporary closures to prevent foreign matter from entering raceways.
- F. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.



- G. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- I. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
  - 1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
- J. Support conduit within 12 inches of enclosures to which attached.
- K. Raceways Embedded in Slabs:
  - 1. Raceways embedded in slabs shall be limited to above grade concrete decks. Embedded conduit shall be limited to servicing floor boxes and equipment located in open spaces away from accessible walls.
  - 2. Install in middle 1/3 of slab thickness where practical and leave at least 2 inches (50 mm) of concrete cover.
  - 3. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
  - 4. Space raceways laterally to prevent voids in concrete.
  - 5. Run conduit larger than 1-inch trade size parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  - 6. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  - 7. Conduits shall run flat. Do not allow conduits to cross.
  - 8. Change from non-metallic raceway to rigid steel before turning up out of the concrete and rising above the floor.
- L. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
  - 1. Run parallel or banked raceways together on common supports.
  - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

- P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- R. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- S. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- T. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- U. Provide pull string and 25% spare capacity in every branch circuit conduit.
- V. Communications and Signal Cabling Systems Raceways: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
  - 1. Electrical conduit (LB's) are not permitted.
  - 2. Conduits shall have no more than two 90 degree bends between pull points or pull boxes.
  - 3. Conduits shall contain no continuous sections longer than 150 ft. without a pull point/box.
  - 4. Conduit for fiber cabling shall have a bend radius of at least 10 times the internal diameter.
  - 5. Conduit for copper cabling less than 2" shall have a bend radius of at least 6 times the internal diameter. Conduit for copper cabling 2" and larger shall have a bend radius of at least 10 times the internal diameter.
  - 6. All conduit ends shall have an insulated bushing.
- W. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
  - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - 2. Where conduits route through, to, or from a hazardous classified space (Class I or II), provide proper seal offs when exiting or entering the hazardous classified space.
  - 3. Where conduits pass between spaces that are maintained at two different vapor pressures.
  - 4. Where otherwise required by NFPA 70.
- X. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel

conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

Y. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
  - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
  - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
  - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
  - d. Attics: 135 deg F temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

Z. Flexible Conduit Connections: Comply with NEMA RV3. Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.

AA. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals. Provide cover clips to cover space between connecting pieces.

BB. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

CC. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

DD. Locate boxes so that cover or plate will not span different building finishes.

EE. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

FF. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

- GG. Set floor boxes level and flush with finished floor surface. Trim non-metallic boxes after installation to fit flush with finished floor surface.
- HH. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
- II. Do not route feeders across roof.
- JJ. Provide a pull box (a handhole for outdoor applications) for each conduit run that exceeds 250 feet. Provide two pull boxes (handholes for outdoor applications) for runs that exceed 500 feet.
- KK. Route conduits in finished areas with exposed ceilings at underside of structural deck or as high as possible.
- LL. Outlet boxes within hazardous locations shall be of the proper class and division as noted in the N.E.C.

### 3.3 INSTALLATION OF UNDERGROUND CONDUIT

#### A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 2 Section "Earthwork" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Division 2 Section "Earthwork."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 2 Section "Earthwork."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
  - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
  - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
5. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, placing them 24 inches o.c. Align planks along the width and along the centerline of conduit.

### 3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes and boxes with bottom below the frost line, 42" below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

### 3.5 SLEEVE INSTALLATION FOR ELECTRICAL and communications PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Through-Penetration Firestop Systems."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
  - 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
  - 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 7 Section "Through-Penetration Firestop Systems."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

### 3.6 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Through-Penetration Firestop Systems."

### 3.8 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

### 3.9 CLEANING

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 260533

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

- 1. Identification for raceway and metal-clad cable.
- 2. Identification for conductors and communication and control cable.
- 3. Underground-line warning tape.
- 4. Warning labels and signs.
- 5. Instruction signs.
- 6. Equipment identification labels.
- 7. Miscellaneous identification products.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

#### 1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

### PART 2 - PRODUCTS

#### 2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for Printed Legend:
  - 1. Power Circuits: Black letters on an orange field.
  - 2. Legend: Indicate system or service and voltage, if applicable.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

#### 2.2 CONDUCTOR, COMMUNICATION AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

#### 2.3 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
  - 1. Not less than 6 inches wide by 4 mils thick.
  - 2. Compounded for permanent direct-burial service.
  - 3. Embedded continuous metallic strip or core.
  - 4. Printed legend shall indicate type of underground line.



## 2.4 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Warning label and sign shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

## 2.5 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
  - 1. Engraved legend with black letters on white face.
  - 2. Punched or drilled for mechanical fasteners.
  - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## 2.6 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Black letters on a white background. Minimum letter height shall be 3/8 inch.
- B. Outdoor Equipment Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

## 2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength: 50 lb, minimum.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in Division 9 painting Sections.
- C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## 2.8 WIRING DEVICE IDENTIFICATION

- A. Description: Self adhesive label with black upper case letters on clear polyester label, font size 7.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Accessible Raceways and Metal-Clad Cables More Than 600 V: Identify with "DANGER-HIGH VOLTAGE" in black letters at least 2 inches high, with self-adhesive vinyl labels. Repeat legend at 10-foot maximum intervals.
- B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service and Feeders More Than 400 A: Identify with orange self-adhesive vinyl label.
- C. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:
  - 1. Fire Alarm System: Red.
  - 2. Security System: Blue and yellow.
  - 3. Telecommunication System: Green and yellow.
  - 4. Control Wiring: Green and red.
- D. Power-Circuit Conductor Identification: For conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape and marker tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- E. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use marker tape. Identify each ungrounded conductor according to source and circuit number as indicated on Drawings. Identify control circuits by control wire number as indicated on shop drawings.
- F. Branch-Circuit Conductor Identification: Mark junction box covers in indelible ink with the panel and breaker numbers of other circuits contained within.
- G. Conductor Identification: Locate at each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection or termination point.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

- J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
  - 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
    - a. Power transfer switches.
    - b. Controls with external control power connections.
  - 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- K. Instruction Signs:
  - 1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
  - 2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
  - 1. Labeling Instructions:
    - a. Indoor Equipment: Engraved, laminated acrylic or melamine label mechanically secured.
    - b. Outdoor Equipment: Stenciled.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
  - 2. Equipment to Be Labeled: If included on project. All items may not be on project.
    - a. Panelboards, electrical cabinets, and enclosures.
    - b. Access doors and panels for concealed electrical items.
    - c. Electrical switchgear and switchboards.
    - d. Transformers.
    - e. Electrical substations.
    - f. Emergency system boxes and enclosures.
    - g. Motor-control centers.
    - h. Disconnect switches.
    - i. Enclosed circuit breakers.
    - j. Motor starters.
    - k. Push-button stations.
    - l. Power transfer equipment.
    - m. Contactors.

- n. Remote-controlled switches, dimmer modules, and control devices.
  - o. Battery inverter units.
  - p. Battery racks.
  - q. Power-generating units.
  - r. Voice and data cable terminal equipment.
  - s. Master clock and program equipment.
  - t. Intercommunication and call system master and staff stations.
  - u. Television/audio components, racks, and controls.
  - v. Fire-alarm control panel and annunciators.
  - w. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
  - x. Monitoring and control equipment.
  - y. Uninterruptible power supply equipment.
  - z. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
  - aa. Breakers or switches at distribution panels.
- M. Wiring Device Identification Labels: On each faceplate install circuit designation label that is consistent with panelboard directories, and as-built plan drawings. Apply labels to receptacle faceplates centered below bottom outlet. Apply labels to toggle switch faceplates on backside.

### 3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location:
  - 1. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
  - 2. Conduit Markers: Provide identification for each power conduit containing conductors rated 400A or greater.
- C. Apply identification devices to surfaces after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
  - 1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.

- c. Phase C: Blue.
  - d. Grounded Conductor (Neutral): White.
3. Colors for 480/277-V Circuits:
- a. Phase A: Brown.
  - b. Phase B: Orange.
  - c. Phase C: Yellow.
  - d. Ground Conductor (Neutral): Grey.
4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
- I. Label information arrangement for 3 lines of text.
- 1. Line one shall describe the panel or equipment. Line one example: "DP-XX," "RP-XX," "T-XX," "EF-XX," etc.
  - 2. Line two shall describe the first disconnecting means feeding this panel or equipment. Line two example: "Fed from DP-XX," "Fed from RP-XX," etc.
  - 3. Line three indicates that location of the disconnecting means as identified in line two. Line three example: "First Floor Elect. Rm #XXX."
  - 4. Line four shall include "Via T-XX" when panel or equipment is fed from a transformer.
- J. Examples:
- |   |   |   |
|---|---|---|
| RP-1A<br>FED FROM DP-1A<br>ELECTRICAL ROOM A100<br>VIA T-1A | EF-1<br>FED FROM MCC-1A<br>MECHANICAL ROOM F101 | LP-1A<br>LOCATED IN<br>ELECTRICAL ROOM A100 |
|---|---|---|
- K. Fusible Enclosed Switches and Distribution Equipment: Install self-adhesive vinyl label indicating fuse rating and type on the outside of door on each fused switch.
- L. Painted Identification: Prepare surface and apply paint according to Division 9 painting Sections.
- M. Degrease and clean surface to receive nameplates.
- N. Install nameplate and labels parallel to equipment lines.
- O. Secure nameplate to equipment front using screws.
- P. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
- Q. Identify conduit using field painting where required.

- R. Paint red colored band on each fire alarm conduit and junction box.
- S. Paint bands 10 feet on center, and 4 inches minimum in width.

END OF SECTION 260553

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

- 1. Identification for raceway and metal-clad cable.
- 2. Identification for conductors and communication and control cable.
- 3. Underground-line warning tape.
- 4. Warning labels and signs.
- 5. Instruction signs.
- 6. Equipment identification labels.
- 7. Miscellaneous identification products.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

#### 1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

### PART 2 - PRODUCTS

#### 2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for Printed Legend:
  - 1. Power Circuits: Black letters on an orange field.
  - 2. Legend: Indicate system or service and voltage, if applicable.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

#### 2.2 CONDUCTOR, COMMUNICATION AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

#### 2.3 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
  - 1. Not less than 6 inches wide by 4 mils thick.
  - 2. Compounded for permanent direct-burial service.
  - 3. Embedded continuous metallic strip or core.
  - 4. Printed legend shall indicate type of underground line.



## 2.4 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Warning label and sign shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

## 2.5 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
  - 1. Engraved legend with black letters on white face.
  - 2. Punched or drilled for mechanical fasteners.
  - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## 2.6 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Black letters on a white background. Minimum letter height shall be 3/8 inch.
- B. Outdoor Equipment Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

## 2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength: 50 lb, minimum.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in Division 9 painting Sections.
- C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## 2.8 WIRING DEVICE IDENTIFICATION

- A. Description: Self adhesive label with black upper case letters on clear polyester label, font size 7.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Accessible Raceways and Metal-Clad Cables More Than 600 V: Identify with "DANGER-HIGH VOLTAGE" in black letters at least 2 inches high, with self-adhesive vinyl labels. Repeat legend at 10-foot maximum intervals.
- B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service and Feeders More Than 400 A: Identify with orange self-adhesive vinyl label.
- C. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:
  - 1. Fire Alarm System: Red.
  - 2. Security System: Blue and yellow.
  - 3. Telecommunication System: Green and yellow.
  - 4. Control Wiring: Green and red.
- D. Power-Circuit Conductor Identification: For conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape and marker tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- E. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use marker tape. Identify each ungrounded conductor according to source and circuit number as indicated on Drawings. Identify control circuits by control wire number as indicated on shop drawings.
- F. Branch-Circuit Conductor Identification: Mark junction box covers in indelible ink with the panel and breaker numbers of other circuits contained within.
- G. Conductor Identification: Locate at each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection or termination point.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

- J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
  - 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
    - a. Power transfer switches.
    - b. Controls with external control power connections.
  - 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- K. Instruction Signs:
  - 1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
  - 2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
  - 1. Labeling Instructions:
    - a. Indoor Equipment: Engraved, laminated acrylic or melamine label mechanically secured.
    - b. Outdoor Equipment: Stenciled.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
  - 2. Equipment to Be Labeled: If included on project. All items may not be on project.
    - a. Panelboards, electrical cabinets, and enclosures.
    - b. Access doors and panels for concealed electrical items.
    - c. Electrical switchgear and switchboards.
    - d. Transformers.
    - e. Electrical substations.
    - f. Emergency system boxes and enclosures.
    - g. Motor-control centers.
    - h. Disconnect switches.
    - i. Enclosed circuit breakers.
    - j. Motor starters.
    - k. Push-button stations.
    - l. Power transfer equipment.
    - m. Contactors.

- n. Remote-controlled switches, dimmer modules, and control devices.
  - o. Battery inverter units.
  - p. Battery racks.
  - q. Power-generating units.
  - r. Voice and data cable terminal equipment.
  - s. Master clock and program equipment.
  - t. Intercommunication and call system master and staff stations.
  - u. Television/audio components, racks, and controls.
  - v. Fire-alarm control panel and annunciators.
  - w. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
  - x. Monitoring and control equipment.
  - y. Uninterruptible power supply equipment.
  - z. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
  - aa. Breakers or switches at distribution panels.
- M. Wiring Device Identification Labels: On each faceplate install circuit designation label that is consistent with panelboard directories, and as-built plan drawings. Apply labels to receptacle faceplates centered below bottom outlet. Apply labels to toggle switch faceplates on backside.

### 3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location:
  - 1. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
  - 2. Conduit Markers: Provide identification for each power conduit containing conductors rated 400A or greater.
- C. Apply identification devices to surfaces after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
  - 1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.

- c. Phase C: Blue.
  - d. Grounded Conductor (Neutral): White.
3. Colors for 480/277-V Circuits:
- a. Phase A: Brown.
  - b. Phase B: Orange.
  - c. Phase C: Yellow.
  - d. Ground Conductor (Neutral): Grey.
4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
- I. Label information arrangement for 3 lines of text.
- 1. Line one shall describe the panel or equipment. Line one example: "DP-XX," "RP-XX," "T-XX," "EF-XX," etc.
  - 2. Line two shall describe the first disconnecting means feeding this panel or equipment. Line two example: "Fed from DP-XX," "Fed from RP-XX," etc.
  - 3. Line three indicates that location of the disconnecting means as identified in line two. Line three example: "First Floor Elect. Rm #XXX."
  - 4. Line four shall include "Via T-XX" when panel or equipment is fed from a transformer.
- J. Examples:
- |   |   |   |
|---|---|---|
| RP-1A<br>FED FROM DP-1A<br>ELECTRICAL ROOM A100<br>VIA T-1A | EF-1<br>FED FROM MCC-1A<br>MECHANICAL ROOM F101 | LP-1A<br>LOCATED IN<br>ELECTRICAL ROOM A100 |
|---|---|---|
- K. Fusible Enclosed Switches and Distribution Equipment: Install self-adhesive vinyl label indicating fuse rating and type on the outside of door on each fused switch.
- L. Painted Identification: Prepare surface and apply paint according to Division 9 painting Sections.
- M. Degrease and clean surface to receive nameplates.
- N. Install nameplate and labels parallel to equipment lines.
- O. Secure nameplate to equipment front using screws.
- P. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
- Q. Identify conduit using field painting where required.

- R. Paint red colored band on each fire alarm conduit and junction box.
- S. Paint bands 10 feet on center, and 4 inches minimum in width.

END OF SECTION 260553

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 SCOPE

- A. The contractor shall furnish short-circuit and protective device coordination studies as prepared by the electrical equipment manufacturer.
- B. The contractor shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in NFPA 70E -Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2018, Annex D prepared by the electrical equipment manufacturer.
- C. The scope of the studies shall include all new distribution equipment supplied by the equipment manufacturer under this contract as well as all directly affected existing distribution equipment at the customer facility.

1.3 REFERENCES

- A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  - 1. IEEE 141 - Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems

2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis
4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
6. IEEE 1584 -Guide for Performing Arc-Flash Hazard Calculations

B. American National Standards Institute (ANSI):

1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

C. The National Fire Protection Association (NFPA)

1. NFPA 70 -National Electrical Code, latest edition
2. NFPA 70E – Standard for Electrical Safety in the Workplace, latest edition.

#### 1.4 SUBMITTALS FOR REVIEW/APPROVAL

- A. The short-circuit and protective device coordination studies shall be submitted to the design engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

#### 1.5 SUBMITTALS FOR CONSTRUCTION

- A. The results of the short-circuit, protective device coordination, and arc flash hazard analysis studies shall be summarized in a final report. Report shall be provided on electronic media. All literature shall be combined in one document and shall be properly bookmarked with all applicable sections.

B. The report shall include the following sections:

1. Executive Summary.
2. Descriptions, purpose, basis and scope of the study.
3. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties.
4. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection.
5. Fault current calculations including a definition of terms and guide for interpretation of the computer printout.
6. Details of the incident energy and flash protection boundary calculations.
7. Recommendations for system improvements, where needed.



8. One-line diagram.

- C. Arc flash labels shall be provided in hard copy and a copy of the computer analysis software viewer program is required to provide arc flash labels in electronic format.

## 1.6 QUALIFICATIONS

- A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.
- B. The Registered Professional Electrical Engineer shall be a full-time employee of the equipment manufacturer.
- C. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.
- D. The equipment manufacturer shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analysis it has performed in the past year.

## 1.7 COMPUTER SOFTWARE PROGRAMS

- A. Computer Software Programs: Subject to compliance with requirements, provide products by one of the following:
1. EDSA Micro Corporation.
  2. SKM Systems Analysis, Inc.
  3. ESA Inc.
  4. CGI CYME.
  5. Operation Technology, Inc.

## PART 2 - PRODUCTS

### 2.1 STUDIES

- A. Contractor to furnish short-circuit and protective device coordination studies as prepared by equipment manufacturer.
- B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D prepared by the equipment manufacturer.

### 2.2 DATA COLLECTION

- A. Contractor shall furnish all data as required by the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution

equipment shop drawings and/or prior to the release of the equipment for manufacturing.

- B. Source combination may include present and future motors and generators.
- C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner.
- D. If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data to satisfy the study requirements.

### 2.3 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY

- A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standard 141-1993.
- B. Transformer design impedances shall be used when test impedances are not available.
- C. Provide the following:
  - 1. Calculation methods and assumptions
  - 2. Selected base per unit quantities
  - 3. One-line diagram of the system being evaluated
  - 4. Source impedance data, including electric utility system and motor fault contribution characteristics
  - 5. Tabulations of calculated quantities
  - 6. Results, conclusions, and recommendations.
- D. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:
  - 1. Electric utility's supply termination point
  - 2. Incoming switchgear
  - 3. Unit substation primary and secondary terminals
  - 4. Low voltage switchgear
  - 5. Motor control centers
  - 6. Standby generators and automatic transfer switches
  - 7. Branch circuit panelboards
  - 8. Other significant locations throughout the system.
- E. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.
- F. Protective Device Evaluation:
  - 1. Evaluate equipment and protective devices and compare to short circuit ratings
  - 2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses
  - 3. Notify design engineer in writing, of existing, circuit protective devices improperly rated for the calculated available fault current.

#### 2.4 PROTECTIVE DEVICE COORDINATION STUDY

- A. Proposed protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.
- B. Include on each TCC graph, a complete title and one-line diagram with legend identifying the specific portion of the system covered.
- C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
- D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
- E. Plot the following characteristics on the TCC graphs, where applicable:
  - 1. Electric utility's overcurrent protective device
  - 2. Medium voltage equipment overcurrent relays
  - 3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
  - 4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
  - 5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
  - 6. Conductor damage curves
  - 7. Ground fault protective devices, as applicable
  - 8. Pertinent motor starting characteristics and motor damage points, where applicable
  - 9. Pertinent generator short-circuit decrement curve and generator damage point
  - 10. The largest feeder circuit breaker in each motor control center and applicable panelboard.
- F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

#### 2.5 ARC FLASH HAZARD ANALYSIS

- A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2018, Annex D.
- B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
- C. The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 125 kVA where work could be performed on energized parts.
- D. Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm<sup>2</sup>.
- E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations

- F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.
- G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:
  - 1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.
  - 2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).
- H. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.
- I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.
- J. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
- K. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

## 2.6 REPORT SECTIONS

- A. Input data shall include, but not be limited to the following:
  - 1. Feeder input data including feeder type (cable or bus), size, length, number per phase, conduit type (magnetic or non-magnetic) and conductor material (copper or aluminum).
  - 2. Transformer input data, including winding connections, secondary neutral-ground connection, primary and secondary voltage ratings, kVA rating, impedance, % taps and phase shift.

3. Generation contribution data, (synchronous generators and Utility), including short-circuit reactance ( $X''_d$ ), rated MVA, rated voltage, three-phase and single line-ground contribution (for Utility sources) and X/R ratio.
  4. Motor contribution data (induction motors and synchronous motors), including short-circuit reactance, rated horsepower or kVA, rated voltage, and X/R ratio.
- B. Short-Circuit Output Data shall include, but not be limited to the following reports:
1. Low Voltage Fault Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
    - a. Voltage
    - b. Calculated fault current magnitude and angle
    - c. Fault point X/R ratio
    - d. Equivalent impedance
  2. Momentary Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
    - a. Voltage
    - b. Calculated symmetrical fault current magnitude and angle
    - c. Fault point X/R ratio
    - d. Calculated asymmetrical fault currents
      - 1) Based on fault point X/R ratio
      - 2) Based on calculated symmetrical value multiplied by 1.6
      - 3) Based on calculated symmetrical value multiplied by 2.7
    - e. Equivalent impedance
  3. Interrupting Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
    - a. Voltage
    - b. Calculated symmetrical fault current magnitude and angle
    - c. Fault point X/R ratio
    - d. No AC Decrement (NACD) Ratio
    - e. Equivalent impedance
    - f. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a symmetrical basis
    - g. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a total basis
- C. Recommended Protective Device Settings:
1. Phase and Ground Relays:
    - a. Current transformer ratio
    - b. Current setting
    - c. Time setting
    - d. Instantaneous setting
    - e. Recommendations on improved relaying systems, if applicable.

2. Circuit Breakers:
  - a. Adjustable pickups and time delays (long time, short time, ground)
  - b. Adjustable time-current characteristic
  - c. Adjustable instantaneous pickup
  - d. Recommendations on improved trip systems, if applicable.

D. Incident energy and flash protection boundary calculations

1. Arcing fault magnitude
2. Protective device clearing time
3. Duration of arc
4. Arc flash boundary
5. Working distance
6. Incident energy
7. Hazard Risk Category
8. Recommendations for arc flash energy reduction

### PART 3 - EXECUTION

#### 3.1 FIELD ADJUSTMENT

- A. The contractor shall adjust relay and protective device settings according to the recommended settings table provided by the coordination study.
- B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.
- C. Notify design engineer in writing of any required major equipment modifications.

#### 3.2 ARC FLASH WARNING LABELS

- A. The contractor shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.
- B. All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the owner and after any system changes, upgrades or modifications have been incorporated in the system.
- C. The label for equipment where arc incident energy is calculated shall include the following, at a minimum:
  1. Location designation
  2. Nominal system voltage
  3. Arc flash boundary
  4. Incident energy
  5. Working distance
  6. Engineering report number, revision number and issue date.

- D. The label for equipment where arc incident energy is not calculated shall include the following, at a minimum:
  - 1. Location designation
  - 2. Nominal system voltage
  - 3. Arc flash boundary from NFPA 70E 2018 Table 130.7(C) 15(a)
  - 4. Arc flash PPE category from NFPA 70E 2018 Table 130.7(C) 15(a)
  - 5. Engineering report number, revision number and issue date.
  
- E. Labels shall be machine printed, with no field markings.
  
- F. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
  - 1. For each 480 and 208 volt panelboard, one arc flash label shall be provided.
  - 2. For each motor control center, one arc flash label shall be provided.
  - 3. For each low voltage switchboard, one arc flash label shall be provided.
  - 4. For each switchgear, one flash label shall be provided.
  - 5. For medium voltage switches one arc flash label shall be provided
  
- G. Labels shall be field installed by the contractor.

END OF SECTION 260573

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following lighting control devices:

- 1. Time controllers.
- 2. Outdoor and indoor photoelectric control.
- 3. Occupancy sensors.
- 4. Outdoor motion sensors.
- 5. Lighting contactors.
- 6. Wall digital time switches.

- B. Related Sections include the following:

- 1. Division 26 Section "Electrical General Requirements".



2. Division 26 Section "Wiring Devices" for wall-box dimmers and manual light switches.
3. Division 26 Section "Dimming Controls" for architectural dimming system equipment.
4. Division 26 Section "Lighting Control Systems" for programmable lighting systems.

### 1.3 REFERENCES

- A. IEEE C62.41: Guide for Surge Voltages in Low-Voltage AC Power Circuits.
- B. IEEE C136.10: Standard for Roadway Lighting Equipment Locking-Type Photocontrol Devices and Mating Receptacle Physical and Electrical Interchangeability and Testing.
- C. NEMA ICS 2: Industrial Control and Systems Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC Part 8: Disconnect Devices for Use in Industrial Control Equipment.
- D. NFPA 70: National Electrical Code.
- E. UL 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- F. UL 486B: Wire Connectors for Use with Aluminum Conductors.
- G. UL 773: Plug-in, Locking Photocontrols for Use with Area Lighting.
- H. UL 773A: Nonindustrial Photoelectric Switches for Lighting Control.
- I. UL 917: Clock Operated Switches.
- J. UL 1449: Surge Protective Devices.
- K. UL 1598: Luminaires.
- L. NECA 130-2010: Installing and Maintaining Wiring Devices.

### 1.4 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.
- C. ULTRASONIC: Active emission of at least 35 kHz sound waves, using Doppler reflectance to detect motion.
- D. MICROPHONIC: Passive reception to listen for continued occupancy, with circuitry to filter out white noise.
- E. MULTI-Tech: Using PIR and ultrasonic or microphonic technologies in one sensor.

## 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated including physical data and electrical performance.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
  - 1. Lighting plan showing location, orientation, and coverage area of each sensor.
  - 2. Interconnection diagrams showing field-installed wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. Include the following:
  - 1. Description of operation and servicing procedures.
  - 2. List of major components.
  - 3. Recommended spare parts.
  - 4. Programming instructions and system operation procedures.

## 1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

## 1.7 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
- B. Coordinate interface of lighting control devices with temperature controls specified in Division 23.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site under provisions of Division 26 Section "Electrical General Requirements".
- B. Store and protect products under provisions of Division 26 Section "Electrical General Requirements".

## PART 2 - PRODUCTS

### 2.1 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

- A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

## 2.2 TIME CONTROLLERS

### A. Manufacturers:

1. Intermatic, Inc.
2. TORK.

### B. General

1. Provide NEMA Type 1-general purpose steel enclosure with corrosion-resistant primer and baked enamel finish in manufacturer's standard color.
2. Provide enclosure suitable for surface mounting with hinged front; padlock hasp; and side, bottom, and back knockouts for conduit connections.
3. Provide heavy-duty pressure terminals suitable for wire sizes up to no. 8 AWG.

### C. Digital Time Controller: Electronic, solid-state programmable units with alphanumeric display complying with UL 917.

1. Contact Configuration: SPDT.
2. Contact Rating Normally Open: (20-A inductive or resistive, 120-277-V ac, 20-A ballast load, 120-277 V ac.) (10-A inductive or resistive, 120-277-V ac, 10-A ballast load, 120 277 V ac.)
3. Contact Rating Normally Closed: 10-A inductive or resistive, 120-277-V ac, 10-A ballast load, 120-277 V ac.
4. Input Voltage:120 volts.
5. Programs: 2 channels.
  - a. For each channel, 7 day or full year load control, minimum 1,000 on/off operations with one-minute programming resolution; minimum 99 holiday event scheduling; automatic adjustment for daylight savings (with disable); automatic leap year compensation; manual override ON and OFF to the next scheduled event; LCD display.
6. Circuitry: Allow connection of a photoelectric relay as substitute for on and off function of a program on selected channels.
7. Astronomical Time: Provide astronomic feature adjustable from 10° to 60° Northern and Southern latitudes with 1-99 minute adjustable offset from sunrise to sunset for All channels.
8. Battery Backup: Field replaceable lithium battery with minimum 8 year life for schedules and time clock.

### D. Electromechanical-Dial Time Controller: Type complying with UL 917.

1. Contact Configuration: As indicated.
2. Contact Rating: 40 amperes tungsten, 120-277 V ac.
3. Input Voltage: as indicated.
4. Program: 24 hour dial, which can perform a minimum of 10 On/Off operations within a 24-hour period. Provide a minimum of 1 hour setting for ON or OFF operations and maximum ON time of 20 hours.
  - a. Circuitry: Allow connection of a photoelectric relay as substitute for on and off function of a program.
5. Program: Astronomical time dial which turns load on at sunset and turns load off at sunrise or can be set from 8:30pm to 2:30am. Provide dial suitable for Project location.
6. Accessories:

- a. Provide time control with day omitting feature which permits override of time control for manually selected days over a seven day period.

## 2.3 OUTDOOR PHOTOELECTRIC CONTROL

### A. Manufacturers:

1. Intermatic, Inc.
2. Square D.
3. TORK.

### B. General

1. Provide fully-gasketed, weathertight enclosure constructed of die cast zinc, with one-half inch conduit nipple for mounting purposes, and with positioning lug to permit full 360-degree adjustable orientation of photocell.
2. Provide hermetically-sealed, one-inch-diameter, cadmium sulphide photoelectric cell with manual, light level selector.
3. Provide photoelectric control suitable for an operating temperature range of minus 40 degrees F to plus 140 degrees F.

### C. Description: Solid state, with SPST dry contacts rated for LED lighting loads, to operate connected load, relay, contactor coils, or microprocessor input, and complying with UL 773A.

1. Light-Level Monitoring Range: Adjustable turn-on range of 1 to 5 footcandle (11 to 54 lux) and adjustable turn-off range of 3 to 15 footcandle (32 to 1662 lux), and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
2. Time Delay: Adjustable delay up to two minutes to prevent false operation.
3. Contacts: Normally closed, fail on.
4. Electrical: Provide photocell with operating voltage rated to switch the load directly unless otherwise indicated.
5. Surge Protection: Metal-oxide varistor type, complying with IEEE C62.41 for Category A1 locations.
6. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the North sky exposure.
7. Provide hermetically-sealed, one inch diameter, cadmium sulphide photoelectric cell with manual, 2 to 50 footcandle , light level selector.

### D. Description: Solid state, with DPST dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; and complying with UL 773.

1. Light-Level Monitoring Range: 1.5 to 10 footcandle, with an adjustment for turn-on and turn-off levels within that range.
2. Time Delay: 15-second minimum, to prevent false operation.
3. Lightning Arrester: Air-gap type.
4. Mounting: Twist lock complying with IEEE C136.10, with base and stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the North sky exposure.
5. Provide hermetically-sealed, one inch diameter, cadmium sulphide photoelectric cell with manual, 2 to 50 footcandle , light level selector.
6. Provide photoelectric control suitable for an operating temperature range of minus 30 degrees F to plus 140 degrees F .

## 2.4 INDOOR PHOTOELECTRIC CONTROL

### A. Manufacturers:

1. Wattstopper LS-101.
2. Sensorswitch CM-PC.

### B. Photoelectric Sensor: Solid-state, light-level sensor unit utilizing an internal photoconductive cell to detect changes in lighting levels and capable of controlling any lighting source.

1. Housing: White, thermoplastic, tamper resistant, ceiling mount.
2. Sensor shall operate on 24V DC power through a control unit which supplies DC power to the sensor and provides relay contacts to control the lighting load and auxiliary contacts.
3. Light-Level Monitoring Range: 10 to 200 footcandle, with an adjustment for turn-on and turn-off levels within that range.
4. Deadband: Adjustable range of 10 to 300%.
5. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
6. Indicator: Two LEDs to indicate the beginning of on and off cycles.
7. Manual override function.
8. Provide indoor photoelectric switches and control units from single manufacturer.
9. Provide indoor photoelectric switches from same manufacturer as occupancy sensors.
10. Provide all control units and relays required to interface with occupancy sensors as required.

### C. Indoor Photoelectric Sensor Control Units:

1. Description: Transformer and relay combined in single unit to provide 24DC power to sensors and provide 20A contact(s) for control of lighting loads at 120 or 277V. Control unit input power shall be from unswitched leg of lighting circuit it is controlling.
  - a. Control units shall be provided as required to power indoor photoelectric sensor, control lighting loads and provide a minimum of one auxiliary contact.
  - b. Sensor control units shall mount external to 4" sq junction box in the ceiling space. Wiring between control unit and photoelectric switch shall be plenum rated.
  - c. Locate control unit in accessible location in gyp-board ceilings, adjacent to return air grilles, or provide access panel.
  - d. Additional auxiliary relay modules shall be provided as required to provide control of all lighting circuits and additional auxiliary contacts as required.
  - e. It is acceptable to provide controls and auxiliary contacts as required integral to the sensor, provided all required contacts are provided.
  - f. Maximum of 3 sensors per power pack. Verify exact quantities required with manufacturer.

## 2.5 OCCUPANCY SENSORS

### A. General

1. Coordinate occupancy sensor locations, coverages and required quantities with manufacturer's recommendations. Coverage areas indicated on the Drawings are for minor motion (6 to 8 inches of hand movement). Provide additional occupancy sensors and control units as required to achieve complete minor motion coverage of the space indicated.
2. Adjust occupancy sensors and test that complete minor motion coverage is obtained in accordance with Part 3. Provide written confirmation of testing to owner, architect and engineer.
3. Provide occupancy sensors with a bypass switch to override the "ON" function in the event of sensor failure.
4. Provide occupancy sensors with an LED indicator indicating when motion is being detected during testing and normal operation of the sensor.
5. Provide occupancy sensors and occupancy sensor control units from single manufacturer.

B. Wall Switch Passive Infrared Occupancy Sensor

1. Manufacturers:
  - a. Perfect Sense - PS-PWS
  - b. Wattstopper PW-100.
  - c. Hubbell Building Automation SOM 101.
  - d. Greengate OSW-P-0451-W.
  - e. Sensorswitch WSD.
  - f. Philips LRS2210.
  - g. Leviton ODS10-IDW.
2. Description: Wall mounted, 180° coverage, passive infrared sensing occupancy sensor.
  - a. Electrical Characteristics: Capable of switching up to 800W fluorescent or incandescent lighting loads at 120V and 1200 watts fluorescent loads at 277V.
  - b. Functions: Automatic ON/Automatic OFF, or Manual ON/Automatic OFF operation, field selectable. Integral manual override pushbutton switch.
  - c. Adjustments: User adjustable sensitivity and time delay. Time delay shall be adjustable from 30 seconds to 30 minutes. Ambient light sensing shall be adjustable from 20 footcandle to 300 footcandle, with override.
  - d. Ambient Light Sensor: Integral ambient light sensor to switch off lights when sufficient daylight is present.
  - e. Device Body: White, plastic with momentary on/off override pushbutton designed to mount in a standard switch box with "decora" style switch plate.
3. Dual Level Switching: Provide occupancy sensor capable of controlling two switch legs independently where dual level switching is indicated.
  - a. Manufacturers:
    - 1) Perfect Sense PWD.
    - 2) Wattstopper PW-200.
    - 3) Hubbell Building Automation SOM-102.
    - 4) Greengate OSW-P-0451-DMV.
    - 5) Sensorswitch WSD-2P.
    - 6) Philips LRS2215.
    - 7) Leviton ODSOD-IDW.

C. 360° Ceiling Mounted Dual Technology Occupancy Sensor

1. Manufacturers:

- a. Perfect Sense CDS.
- b. Wattstopper DT 300
- c. Hubbell Building Automation "OMNI-DT" Series.
- d. Greengate OMC-DT-2000-R.
- e. Sensorswitch CM-PDT-R.
- f. Philips LRM2255.
- g. Leviton OSC10-MOW.

2. Description: Ceiling mounted, 360° coverage, multi-tech sensing occupancy sensor.

- a. Housing: White, thermoplastic, tamper resistant ceiling mount.
- b. Functions: Automatic ON must sense motion from both ultrasonic and infrared sensing elements. Either technology shall maintain ON, with adjustable time delays.
- c. Adjustments: User adjustable sensitivity adjustment shall be provided for each sensing technology. Time delay shall be adjustable from 30 seconds to 30 minutes.
- d. Sensor shall operate on 24V DC power through control unit which supplies DC power to the sensor and provides relay contacts to control the lighting load and auxiliary contacts.
- e. Manual override function.

D. 110° Wall Mounted Dual Technology Occupancy Sensor

1. Manufacturers:

- a. Perfect Sense DTC.
- b. Wattstopper DT-200
- c. Hubbell Building Automation "LO-DT" Series.
- d. Sensorswitch WV-PDT-R/WV-BR.
- e. Philips LRM2265.
- f. Leviton OSW12-MOW.

2. Description: Wall mounted, 110° coverage, multi-tech occupancy sensor.

- a. Housing: White, thermoplastic, tamper resistant with swivel bracket for wall or ceiling mounting.
- b. Functions: Automatic ON must sense motion from both sensing elements. Either technology shall maintain ON, with adjustable time delays.
- c. Adjustments: User adjustable sensitivity adjustment shall be provided for each sensing technology. Time delay shall be adjustable from 30 seconds to 15 minutes.
- d. Sensor Orientation: Orient sensor in room such that sensor will not detect motion through open door which could cause false activation.
- e. Sensor shall operate on 24V DC power through control unit which supplies DC power to the sensor and provides relay contacts to control the lighting load and auxiliary contacts.
- f. Manual override function.

E. 360° Ceiling Mounted Ultrasonic Occupancy Sensors

1. Manufacturers:

- a. Perfect Sense WDS.
  - b. Wattstopper "WT" Series.
  - c. Hubbell Building Automation "OMNI-US" Series.
  - d. Greengate OPC-U-2000.
  - e. Sensorswitch CM MPT-10.
  - f. Philips LRM2255.
  - g. Leviton OSC20-UOW.
2. Description: Ceiling mounted, 360° coverage, ultrasonic or microphonics sensing occupancy sensor.
    - a. Housing: White, thermoplastic, tamper resistant.
    - b. Adjustments: User adjustable sensitivity and time delay. Time delay shall be adjustable from 30 seconds to 15 minutes.
    - c. Sensor shall operate on 24V DC power through control unit which supplies DC power to the sensor and provides relay contacts to control the lighting load and auxiliary contacts.
    - d. Manual override function.
- F. 360° Ceiling Mounted Passive Infrared Occupancy Sensor.
1. Manufacturers:
    - a. Perfect Sense CPS.
    - b. Wattstopper CI-200.
    - c. Hubbell Building Automation OMNI-IR.
    - d. Greengate OMC-P-04500-R.
    - e. Sensorswitch CM-9.
    - f. Philips LRM2250.
    - g. Leviton OSC04-IOW.
  2. Description: Ceiling mounted, 360° coverage, infrared sensing occupancy sensor.
    - a. Housing: White, thermoplastic, tamper resistant ceiling mount.
    - b. Adjustments: User adjustable sensitivity adjustment shall be provided for each sensing technology. Time delay shall be adjustable from 30 seconds to 30 minutes.
    - c. Sensor shall operate on 24V DC power through control unit which supplies DC power to the sensor and provides relay contacts to control the lighting load and auxiliary contacts.
    - d. Manual override function.
- G. Occupancy Sensor Control Units:
1. Description: Transformer and relay combined in single unit to provide 24DC power to sensors and provide 20A contact(s) for control of lighting loads at 120 or 277V. Control unit input power shall be from unswitched leg of lighting circuit it is controlling.
    - a. Control units shall be provided as required to power ceiling mounted occupancy sensors, control lighting loads and provide a minimum of one auxiliary contact.
    - b. Occupancy sensor control units shall mount external to 4" sq junction box in the ceiling space. Wiring between control unit and occupancy sensor shall be plenum rated.



- c. Locate control unit in accessible location in gyp-board ceilings, adjacent to return air grilles, or provide access panel.
- d. Additional auxiliary relay modules shall be provided as required to provide control of all lighting circuits and additional auxiliary contacts as required.
- e. It is acceptable to provide controls and auxiliary contacts as required integral to the ceiling sensor, provided all required contacts are provided.
- f. Maximum of 3 sensors per power pack. Verify exact quantities required with manufacturer.

## 2.6 OUTDOOR MOTION SENSORS (PIR)

### A. Outdoor Motion Sensors (PIR).

1. Description: Suitable for operation in ambient temperatures ranging from minus 40 deg F to 130 deg F, UL 773A rated as raintight.
  - a. Operation: Turn lights on when sensing infrared energy changes between background and moving body in area of coverage; with an adjustable time delay for turning lights off.
  - b. Housing: White, thermoplastic, tamper resistant, raintight.
  - c. Sensor Output:
    - 1) Suitable for switching 300 W of tungsten load at 120- or 277-V ac.
    - 2) Sensor shall be compatible with all electronic ballasts and PL lamp ballast systems.
  - d. Lampholders: Polycarbonate, UL 1598 rated for wet locations and suitable for use with PAR 20 or PAR 38 lamps, 150 watts maximum per lamp.
  - e. Sensor Output: Sensor shall operate on 24V DC power through control unit which supplies DC power to the sensor and provides relay contacts to control the lighting load and auxiliary contacts.
  - f. Mounting: Sensor: Suitable for mounting in any position on a standard outdoor junction box.
  - g. Adjustable Time Delay. Adjustable from 12 seconds to 16 minutes.
  - h. Automatic Light-Level Sensor: Adjustable from 0.5 to 200 footcandle; keeps lighting off during daylight hours.
  - i. Detection Coverage: Up to 52.5 feet, with a field of view of 270 degrees.
  - j. Provide motion sensors and control units from single manufacturer.
  - k. Provide outdoor motion sensors from same manufacturer as occupancy sensors.

### B. Outdoor Motion Sensor Control Units:

1. Description: Transformer and relay combined in single unit to provide 24DC power to sensors and provide 20A contact(s) for control of lighting loads at 120 or 277V. Control unit input power shall be from unswitched leg of lighting circuit it is controlling.
  - a. Control units shall be provided as required to power motion sensors, control lighting loads and provide a minimum of one auxiliary contact.
  - b. Motion sensor control units shall mount external to 4" sq junction box in the ceiling space. Wiring between control unit and motion sensor shall be plenum rated.
  - c. Locate control unit in accessible location in gyp-board ceilings, adjacent to return air grilles, or provide access panel.

- d. Additional auxiliary relay modules shall be provided as required to provide control of all lighting circuits and additional auxiliary contacts as required.
- e. It is acceptable to provide controls and auxiliary contacts as required integral to the motion sensor, provided all required contacts are provided.
- f. Maximum of 3 sensors per power pack. Verify exact quantities required with manufacturer.

## 2.7 LIGHTING CONTACTORS

### A. Manufacturers:

1. Cutler-Hammer; Eaton Corporation.
2. Square D Co.
3. General Electric.
4. Siemens.
5. Square D Co; class 8903.

### B. Contactor

1. Electrically-operated mechanically-held unless otherwise indicated open type contactor suitable for panelboard mounting, per NEMA ICS2, with 120 volt, 60 hertz coil and 600 volt, 60 hertz, 20 ampere contacts with size and number of poles indicated.
2. Provide contacts to be 100 percent, continuously rated for all types of ballast and tungsten lighting and resistance loads without the need for in-rush current derating.
3. Provide NEMA type 1 enclosure unless otherwise indicated.
4. Provide NEMA type 1 hinged cover cabinet enclosure sized as required for contactors as indicated on drawings. Mount switches and indicating lights required on front of enclosure. Install terminal strips for connection of all external control wiring connections.
5. Provide bus terminal suitable for panelboard mounting.
6. Provide corrosion-resistant primer treatment with light gray baked acrylic enamel finish.
7. Provide the following control and indicating devices:
  - a. Auxiliary contacts: One field convertible.
  - b. Auxiliary relay to convert maintained-contact type control circuit to momentary-contact type control circuit necessary for contactor control.
  - c. Hand-off-auto selector switch, of the heavy-duty "oil-tight", maintained-contact type, mounted on the front cover with legend plate.
  - d. Control transformer with primary voltage as indicated and 120-volt, single phase, 60 hertz secondary including fuse and fuseholder.
  - e. Green pilot light to indicate "power on" condition. Mount on front cover with legend plate.

## PART 3 - EXECUTION

### 3.1 LIGHTING CONTACTOR INSTALLATION

- A. Install lighting contactors as indicated on plan. Install at accessible locations. Switch controls where provided shall be no higher than 54" or lower than 48".

- B. Demonstrate proper operation of all lighting control functions to the Owner and Engineer.

### 3.2 OUTDOOR PHOTOELECTRIC CONTROL INSTALLATION

- A. Mount photocell on roof or parapet to ½" GRS conduit, supported to building structure below. Coordinate roof penetration with roofing contractor.
- B. Install photoelectric control oriented in the northeast direction and not within any potential shadows.
- C. Adjust photocell sensitivity and delay to meet owner's requirements. Multiple adjustments may be required, as needed.

### 3.3 TIME CONTROLLER INSTALLATION

- A. Install time controller, near contactor control equipment or as indicated on plan. Install at accessible location.
- B. Program time controller as directed by the owner. Train owner in time clock programming.

### 3.4 OCCUPANCY SENSOR INSTALLATION

- A. Install wall mounted occupancy sensors as noted on plan. Arrange occupancy sensors with adjacent switch devices so that device plates line-up and are equally spaced.
- B. Install ceiling mounted sensors at approximate locations as indicated on plan. Sensor manufacturer shall provide quantity of sensors as required to provide complete coverage for rooms.
- C. Locate sensors such that motion through open doors will not falsely activate sensors.
- D. Do not locate ultrasonic sensors within six feet of supply air diffusers.
- E. Locate infrared sensors to avoid obstructions.
- F. Provide the services of a manufacturer's representative for commissioning of occupancy sensor installation. This shall include consultation on layout and location prior to installing sensors, testing of each sensor for compliance with Contract Documents and field adjustment and fine tuning after installation is complete. Provide written confirmation of testing to the Owner, Architect and Engineer.
- G. Field adjustments shall take place in the presence of the owner and the engineer. This shall include owner training on adjustment techniques for the occupancy sensors.

### 3.5 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Conductors and Cables".
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.6 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Electrical Identification."
- B. Label time switches and contactors with a unique designation.

### 3.7 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
  - 2. Operational Test: Verify actuation of each sensor and adjust time delays.
- B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.8 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

END OF SECTION 260923

SECTION 260999 - ELECTRICAL TESTING

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. Related Sections include the following:
  - 1. Division 26 Section "Electrical General Requirements."
  - 2. Division 26 Section "Conductors and Cables."
  - 3. Division 26 Section "Grounding and Bonding."
  - 4. Division 26 Section "Enclosed Switches."
  - 5. Division 26 Section "Enclosed Controllers."
  - 6. Division 26 Section "Surge Protective Devices"
  - 7. Division 26 Section "Switchboards."
  - 8. Division 26 Section "Panelboards."
  - 9. Division 26 Section "Dry Type Transformers (600V and Less)."
  - 10. Division 26 Section "Fuses."
  - 11. Division 26 Section "Electrical Systems Commissioning."

1.2 SECTION INCLUDES

- A. The Electrical Contractor shall engage the services of a recognized corporately independent N.E.T.A. certified testing firm for the purpose of performing inspections and tests as herein specified
- B. The testing firm shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections.
- C. It is the intent of these tests to assure that all tested electrical equipment is operational and within industry and manufacturer's tolerances and is installed in accordance with design Specifications.
- D. The test and inspections shall determine suitability for energization.

- E. Equipment to be tested and inspected shall be the equipment shown on the one line diagram and schedules as required by part three of each individual Specification Section. In addition, all equipment that is part of an emergency distribution system shall be tested.

### 1.3 REFERENCES

- A. All inspections and tests shall be in accordance with the latest version of the following codes and standards except as provided otherwise herein.
  - 1. National Electrical Manufacturer's Association - NEMA
  - 2. American Society for Testing and Materials - ASTM
  - 3. Institute of Electrical and Electronic Engineers - IEEE
  - 4. InterNational Electrical Testing Association - NETA Acceptance Testing Specifications - ATS-2017
  - 5. InterNational Electrical Testing Association - NETA Maintenance Testing Specifications-MTS-2015
  - 6. American National Standards Institute - ANSI C2: National Electrical Safety Code
  - 7. State and Local Codes and Ordinances
  - 8. Insulated Cable Engineers Association - ICEA
  - 9. Association of Edison Illuminating Companies - AEIC
  - 10. Occupational Safety and Health Administration
  - 11. National Fire Protection Association - NFPA
    - a. ANSI/NFPA 70: National Electrical Code
    - b. ANSI/NFPA 70B: Electrical Equipment Maintenance
    - c. NFPA 70E: Electrical Safety Requirements for Employee Workplaces
    - d. ANSI/NFPA 101: Life Safety Code

### 1.4 QUALIFICATIONS

- A. The testing firm shall be a corporately independent testing organization, which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing firm.
- B. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
- C. The lead, on site, technical person and at least 50% of the on site crew shall be currently certified by the InterNational Electrical Testing Association (NETA) or National Institute for Certification in Engineering Technologies in Electrical Power Distribution System Testing.
- D. The testing firm shall only utilize technicians who are regularly employed by the firm on a full-time basis for testing services.
- E. The Contractor shall submit proof of the above qualifications with bid proposal.
- F. The terms used herewithin such as Test Agency, Test Contractor, Testing Laboratory, or Contractor Test Company, shall be construed to mean the testing organization.

G. Acceptable Testing Firms:

1. Northern Electrical Testing; Phone (248) 689-8980.
2. Utilities Instrumentation Services; Phone (734) 424-1200.
3. High Voltage Maintenance Corporation; Phone (248) 305-5596.
4. Powertech Services, Inc.; Phone (810) 720-2280.
5. Power Plus Engineering, Inc.; Phone (800) 765-3120.
6. Premier Power Maintenance, Inc.; (517) 230-6629

1.5 PERFORMANCE REQUIREMENTS

- A. The Electrical Contractor shall supply a suitable and stable source of electrical power to each test site. The testing firm shall specify the power requirements.
- B. The Electrical Contractor shall notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.
- C. The testing firm shall notify the Owner's Representative prior to commencement of any testing.
- D. Any system, material or workmanship, which is found defective on the basis of acceptance tests, shall be reported to the Engineer. The Electrical Contractor shall correct all defects.
- E. The testing organization shall maintain a written record of all tests and shall assemble and certify a final test report.
- F. Safety and Precautions
  1. Safety practices shall include, but are not limited to, the following requirements:
    - a. Occupational Safety and Health Act.
    - b. Accident Prevention Manual for Industrial Operations, National Safety Council.
    - c. Applicable state and local safety operating procedures.
    - d. NETA Safety/Accident Prevention Program.
    - e. Owner's safety practices.
    - f. National Fire Protection Association - NFPA 70E.
    - g. American National Standards for Personnel Protection.
  2. All tests shall be performed with apparatus de-energized except where otherwise specifically required.
  3. The testing organization shall have a designated safety representative on the project to supervise operations with respect to safety.

1.6 TEST INSTRUMENT CALIBRATION

A. Test Instrument Calibration

1. The testing firm shall have a calibration program, which assures that all applicable test instruments are maintained within rated accuracy.

2. The accuracy shall be directly traceable to the National Institute of Standards and Technology.
3. Instruments shall be calibrated in accordance with the following frequency schedule:
  - a. Field instruments: Analog - 6 months maximum Digital - 12 months maximum
  - b. Laboratory instruments: 12 months
  - c. Leased specialty equipment: 12 months (Where accuracy is guaranteed by Lessor)
4. Dated calibration labels shall be visible on all test equipment.
5. Records must be kept up-to-date which show date and results of instruments calibrated or tested.
6. An up-to-date instrument calibration instruction and procedures shall be maintained for each test instrument.
7. Calibrating standard shall be of higher accuracy than that of the instrument tested.

B. Field Test Instrument Standards

1. All equipment used for testing and calibration procedures shall exhibit the following characteristics:
  - a. Maintained in good visual and mechanical condition.
  - b. Maintained in safe, operating condition.

C. Suitability of Test Equipment

1. All test equipment shall be in good mechanical and electrical condition.
2. Selection of metering equipment should be based on knowledge of the waveform of the variable being measured. Digital multi-meters may be average of RMS sensing and may include or exclude the dc component. When the variable contains harmonics of dc offset and, in general, any deviation from a pure sine wave, average sensing, average measuring RMS scaled meters may be misleading. Use of RMS measuring meters is recommended.
3. Field test metering used to check power system meter calibration must have any accuracy higher than that of the instrument being checked.
4. Accuracy of metering in test equipment shall be appropriate for the test being performed.
5. Waveshape and frequency of test equipment output waveforms shall be appropriate for the test and tested equipment.

1.7 TEST REPORTS

- A. A test report shall be generated for each piece of major equipment or groups of equipment and shall include the following:
1. A list of visual and mechanical inspections required by Division 26 Specification Sections in a checklist or similar format.
  2. Test reports, including test values where applicable, for all required electrical tests. Clearly indicate where test values fall outside of the limits of recommended values.
  3. Summary and interpretation of test results detailing problems located and recommended corrective measures.
  4. Record of infrared scan and photos showing potential problem locations.



5. Signed and dated by the testing firm field superintendent stating that all required tests have been completed.
- B. Test reports shall be furnished to the Architect/Engineer within 14 days of the completion each test on an ongoing basis. Original copies of the reports shall be furnished directly to the Architect/Engineer by the testing company prior to formal submittal via the Contractors.

## PART 2 - PRODUCTS (NOT APPLICABLE)

## PART 3 - EXECUTION

### 3.1 THERMOGRAPHIC SURVEY

- A. Visual and Mechanical Inspection
1. Remove all necessary covers prior to scanning.
  2. Inspect for physical, electrical, and mechanical condition.
- B. Equipment to be Scanned
1. All components of the distribution system down to and including branch circuit panelboards and motor control centers. Return 3 months after equipment has been energized and loaded to do a final scan of all equipment.
- C. Provide report indicating the following:
1. Problem area (location of "hot spot").
  2. Temperature rise between "hot spot" and normal or reference area.
  3. Cause of heat rise.
  4. Phase unbalance, if present.
  5. Areas scanned.
- D. Test Parameters
1. Scanning distribution system with ability to detect 1°C between subject area and reference at 30°C.
  2. Equipment shall detect emitted radiation and convert detected radiation to visual signal.
  3. Infrared surveys should be performed during periods of maximum possible loading but not less than twenty percent (20%) of rated load of the electrical equipment being inspected.
- E. Test Results
1. Interpretation of temperature gradients requires an experienced technician. Some general guidelines are:
    - a. Temperature gradients of 37F to 44.6F indicate possible deficiency and warrant investigation.

- b. Temperature gradients of 44.6F to 59F indicate deficiency; repair as time permits.
- c. Temperature gradients of 61F and above indicate major deficiency; repair immediately.

END OF SECTION 260999

SECTION 262200 - DRY-TYPE TRANSFORMERS (600 V AND LESS)

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 750 kVA:
  - 1. Distribution transformers.
  - 2. Control and signal transformers.
- B. Related Section includes the following:
  - 1. Division 26 Section "Electrical General Requirements."
  - 2. Division 26 Section "Grounding and Bonding."
  - 3. Division 26 Section "Conductors and Cables."
  - 4. Division 26 Section "Raceways and Boxes."
  - 5. Division 26 "Hangers and Supports for Electrical Systems" for concrete bases.

1.3 REFERENCES

- A. ANSI/IEEE C57.12.9: Test Code for Dry-Type Distribution and Power Transformers

- B. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum)
- C. NEMA ST 1: Specialty Transformers
- D. NEMA ST 20: Dry Type Transformers for General Applications
- E. NEMA TP 1: Guide for Determining Energy Efficiency for Distribution Transformers
- F. NEMA TP 2: Standard Test Method for Measuring the Energy Consumption of Distribution Transformers
- G. NETA ATS: Acceptable Testing Specifications for Electrical Power Distribution Equipment and Systems
- H. NFPA 70: National Electrical Code
- I. UL 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors
- J. UL 486B: Wire Connectors for Use with Aluminum Conductors
- K. UL 506: Specialty Transformers
- L. UL 1561: Dry-Type General Purpose and Power Transformers

#### 1.4 SUBMITTALS

- A. Product Data Include rated nameplate data, capacities, weights, dimensions, utility or manufacturer's anchorage and base recommendations, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.
  - 1. Transformer Inrush: Provide time-current coordination curves demonstrating transformer inrush and ANSI damage curves with primary overcurrent device selections to clear inrush yet still protecting damage curve.
- B. Shop Drawings: Wiring and connection diagrams.
- C. Qualification Data: Testing agency.
- D. Source quality-control test reports. Include loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.
- E. Output Settings Reports: Record of tap adjustments specified in Part 3.

#### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined in OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Transformer Inrush: Provide time-current coordination curves demonstrating transformer inrush and ANSI damage curves with primary overcurrent device selections to clear inrush yet still protecting damage curve.
  2. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise onsite testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with IEEE C 57.12.91.
- D. Comply with NFPA 70.
- E. Energy-Efficient Transformers Rated 15 kVA and Larger: Certified as meeting doe 2016 efficiency levels when tested according to NEMA TP2.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.
  - B. Store, protect, and handle products to site under provisions of Division 26 section "Electrical General Requirements."
  - C. Deliver transformers individually wrapped for protection and mounted on shipping skids.
  - D. Accept transformers on site. Inspect for damage.
  - E. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
  - F. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.
- 1.7 COORDINATION
- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork shall meet load requirements. Requirements for concrete bases for electrical equipment are specified in Division 26 "Hangers and Supports for Electrical Systems."
  - B. Coordinate installation of wall-mounting and structure-hanging supports.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Corporation; Cutler-Hammer Products.

### 2.2 MATERIALS

- A. Cores: Grain-oriented, non-aging silicon steel.
- B. Coils: Continuous windings without splices, except for taps.
  - 1. Internal Coil Connections: Brazed or pressure type.
  - 2. Coil Material: Aluminum.
- C. Vibration Isolation: Isolate core and coil from enclosure using vibration-absorbing mounts.
- D. Grounding: Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

### 2.3 DISTRIBUTION TRANSFORMERS

- A. Description: Factory-assembled and tested, air cooled, dry-type transformer rated for 60 Hz operation. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Provide transformers with base KVA as indicated without the use of internal cooling fans.
- C. Cores: One leg per phase.
- D. Indoor Enclosure: Ventilated, NEMA 250, Type 2. Provide lifting eyes or brackets.
- E. Indoor Transformer Enclosure Finish: Comply with NEMA 250 for "Indoor Corrosion Protection."
  - 1. Finish Color: Gray.
- F. Insulation Class (15 kVA and larger): 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature TP-1 compliant.
- G. Insulation Class (less than 15 kVA): 185 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- H. Basic Impulse Level: 10 kV.
- I. Taps for Transformers Smaller Than 3 kVA: None.

- J. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
- K. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- L. Case Temperature: Do not exceed 35 degrees C rise above ambient at warmest point.
- M. Mounting: Suitable for mounting as indicated.
- N. Wall Brackets: Manufacturer's standard brackets.
- O. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

## 2.4 CONTROL AND SIGNAL TRANSFORMERS

- A. Description: Factory-assembled and tested, self-cooled, two-winding dry type, rated for continuous duty, and 60 Hz operation, complying with NEMA ST 1, and listed and labeled as complying with UL 506.
- B. Ratings: Continuous duty. If rating is not indicated, provide at least 50 percent spare capacity above connected peak load.

## 2.5 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.91.
- B. Provide the following factory tests on each unit provided in accordance with NEMA ST 20:
  - 1. Voltage ratio.
  - 2. Polarity and phase relation.
  - 3. No load losses.
  - 4. Impedance (501 kVA and larger).
  - 5. Applied and induced potential.
- C. Provide the factory tests on the actual transformers provided or on similar units identical to those provided in accordance with NEMA ST 20:
  - 1. Impedance (less than 501 kVA).
  - 2. Temperature rise.
  - 3. Audible sound level.
  - 4. Full load losses.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls and floors for suitable mounting conditions where transformers will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
  - 1. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.
  - 2. Brace wall-mounting transformers as specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Install floor mounted transformers on and anchor to concrete bases according to manufacturer's recommendations.
  - 1. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.
- D. Install floor mounted transformers on and anchor to concrete bases according to manufacturer's recommendations, seismic codes at Project, and requirements in Division 26 section "Vibration and Seismic Controls for Electrical Systems."
  - 1. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.
- E. Identification: Engraved metal or laminated-plastic nameplate mounted with corrosion resistant screws. Provide nameplate according to Division 26 Section "Electrical Identification" indicating the following:
  - 1. Transformer designation (e.g. "T-1").
  - 2. Primary power characteristics (e.g. "480V, 3PH, 3W").
  - 3. Secondary power characteristics (e.g. "208Y/120V, 3PH, 4W").
  - 4. Power rating (e.g. "75 kVA").
  - 5. Power source (e.g. "Fed from DP-1).

### 3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding."
- B. Connect wiring according to Division 26 Section "Conductors and Cables."
- C. Provide conduit according to Division 26 Section "Raceways and Boxes" for connections to transformer case. Make conduit connections to side panel of enclosure.



- D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- E. Check for damage and tighten connections prior to energizing transformer.

### 3.4 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality control tests in accordance with Division 26 section "Electrical Testing" for transformers 75KVA and above:

- 1. Visual and Mechanical Inspection

- a. Inspect for physical damage, cracked insulators, tightness of connections, defective wiring and general mechanical and electrical conditions.
- b. Verify proper core grounding.
- c. Verify proper equipment grounding.
- d. Compare equipment nameplate with single line diagram and report discrepancies.

- 2. Electrical Tests

- a. Perform insulation resistance tests, winding-to-winding and windings-to-ground, utilizing a meg-ohmmeter with test voltage output in accordance with N.E.T.A. Acceptance Testing Specifications, Table 10.5. Test duration shall be for 10 minutes with resistance values tabulated at 30 seconds, 1 minute, and 10 minutes. Calculate Polarization index.
- b. Perform a turns ratio test between windings at every tap position. The final tap setting is to be set at the secondary system rated voltage at full load or as directed by the Architect/Engineer.
- c. Verify proper secondary voltage phase-to-phase and phase-to-neutral after energization and prior to loading.
- d. Test mounting and anchorage devices according to requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

- 3. Test Values

- a. Perform insulation resistance tests in accordance with N.E.T.A. Acceptance Testing Specifications, Table 10.5. Results to be temperature corrected in accordance with Table 10.14.
- b. The polarization index should be above 1.2 unless an extremely high value is obtained initially, such that when doubled will not yield a meaningful value.
- c. Turns ratio test results shall not deviate more than one half percent (0.5%) from either the adjacent coils or the calculated ratio.

### 3.5 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 5 percent. Submit recording and tap settings as test results.

- B. Adjust buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.
- C. Output Settings Report: Prepare a written report that records output voltages and tap settings.

END OF SECTION 262200

SECTION 262413 - SWITCHBOARDS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes service and distribution switchboards rated 600 V and less.
- B. Related Sections:
  - 1. Division 26 “Hangers and Supports for Electrical Systems” for concrete bases.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.

- C. RFI: Radio-frequency interference.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions, utility or manufacturer's anchorage and base recommendations, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Related Submittals:
  - 1. Provide overcurrent device coordination study to demonstrate proper overcurrent device ratings, adjustments, and settings.
- C. Shop Drawings: For each switchboard and related equipment.
  - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details for types other than NEMA 250, Type 1.
    - b. Bus configuration, current, and voltage ratings.
    - c. Short-circuit current rating of switchboards and overcurrent protective devices.
    - d. Descriptive documentation of optional barriers specified for electrical insulation and isolation if specified.
    - e. Utility company's metering provisions with indication of approval by utility company if called out.
    - f. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 2. Wiring Diagrams: Power, signal, and control wiring.
- D. Field quality-control test reports including the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1, include the following:
  - 1. Routine maintenance requirements for switchboards and all installed components.
  - 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  - 3. Time-current curves, including selectable ranges for each type of overcurrent protective device.

## 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.
- B. Source Limitations: Obtain switchboards through one source from a single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with NEMA PB 2, "Deadfront Distribution Switchboards."
- F. Comply with NFPA 70.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in sections or lengths that can be moved past obstructions in delivery path.
- B. Store indoors in clean dry space with uniform temperature to prevent condensation. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.
- C. Handle switchboards according to NEMA PB 2.1 and NECA 400.

## 1.7 PROJECT CONDITIONS

- A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.
- B. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
  - 1. Ambient Temperature: Not exceeding 104 deg F.
  - 2. Altitude: Not exceeding 6600 feet.

## 1.8 COORDINATION

- A. Coordinate layout and installation of switchboards and components with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork shall meet load requirements. Requirements for concrete bases for electrical equipment are specified in Division 26 "Hangers and Supports for Electrical Systems."

## 1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Potential Transformer Fuses: 2 of each size and type.
  - 2. Control-Power Fuses: 2 of each size and type.
  - 3. Fuses for Fused Switches: Equal to 10 percent of amount installed for each size and type, but no fewer than 3 of each size and type.
  - 4. Indicating Lights: 3 of each size and type.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 MANUFACTURED UNITS

- A. Manufacturers:
  - 1. Eaton Corporation; Cutler-Hammer Products.
- B. Front-Connected, Front-Accessible Switchboard:
  - 1. Main devices over 1200A: Fixed, individually mounted.
  - 2. Main devices below 1200A, panel mounted.
  - 3. Branch Devices: panel-mounted.
  - 4. Sections rear aligned.
- C. Nominal System Voltage: As noted on Drawings.
- D. Main-Bus Continuous: As noted on Drawings.
- E. Enclosure: Steel, NEMA 250, Type 1 not over 102 in height.
- F. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
- G. Enclosure Finish for Outdoor Units: Factory-applied finish in manufacturer's standard green color, undersurfaces treated with corrosion-resistant undercoating.

- H. Insulation and isolation for main and vertical buses of feeder sections.
- I. Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.
  - 1. Space-Heater Control: Thermostats to maintain temperature of each section above expected dew point.
  - 2. Space-Heater Power Source: Transformer, factory installed in switchboard.
- J. Utility Metering Compartment: Fabricated compartment and section complying with utility company's requirements. If separate vertical section is required for utility metering, match and align with basic switchboard.
- K. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.
- L. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.
- M. Buses and Connections: Three phase, four wire, unless otherwise indicated.
  - 1. Phase- and Neutral-Bus Material: Tin-plated, high-strength, electrical-grade aluminum alloy with copper- or tin-plated, aluminum circuit-breaker line connections.
    - a. If bus is aluminum, use copper- or tin-plated aluminum for circuit-breaker line connections.
  - 2. Ground Bus: 1/4-by-2-inch-minimum-size, hard-drawn copper of 98 percent conductivity, equipped with pressure connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
  - 3. Contact Surfaces of Buses: Silver plated.
  - 4. Main Phase Buses, Neutral Buses, and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
  - 5. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.
  - 6. Neutral Buses: 100 percent of the ampacity of phase buses, unless otherwise indicated, equipped with pressure connectors for outgoing circuit neutral cables. Bus extensions for busway feeder neutral bus are braced.
- N. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

## 2.3 SURGE PROTECTIVE DEVICES

- A. Direct bus connected type as specified in Division 26 Section "Surge Protective Devices."
- B. Provide Surge Protective Device for switchboards that are part of the emergency distribution system.
- C. Provide Surge Protective Device for switchboards elsewhere where indicated on the drawings.

## 2.4 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: NEMA AB 3, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits.
    - a. Circuit Breakers 250A and Larger: Magnetic trip element with front-mounted, field-adjustable trip setting with restricted access cover.
  2. Electronic trip-unit circuit breakers shall have RMS sensing, field-replaceable rating plug, and the following field-adjustable settings with restricted access cover:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and  $I^2t$  response.
  3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  4. GFCI Circuit Breakers: Single- and two-pole configurations with 5 or 30-mA trip sensitivity as required.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
  2. Application Listing: Appropriate for application; Type HACR for heating, air-conditioning, and refrigerating equipment.
  3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  4. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system, specified in Division 26 Section "Electrical Power Monitoring and Control."
  5. Shunt Trip: 120-V trip coil energized from separate circuit.
  6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
  7. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
- C. Enclosed, Insulated-Case Circuit Breaker: Fully rated, encased-power circuit breaker with interrupting capacity rating to meet available fault current.
1. Fixed circuit-breaker mounting.
  2. Two-step, stored-energy closing.
  3. Microprocessor-based trip units with interchangeable rating plug, LED trip indicators, and the following field-adjustable settings with restricted access cover.
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments with  $I^2t$  response.



- d. Ground-fault pickup level, time delay, and I<sup>2</sup>t response.
  4. Remote trip indication and control.
  5. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control"
  6. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
- D. Circuit breaker selection for transformer primary protection:
1. Circuit Breaker Selection for Transformer Primary Protection: Provide circuit breakers with time-current characteristics to clear transformer inrush currents while still providing protection for the ANSI through-fault protection curve. Provide circuit breakers with adjustable magnetic trip or electronic trip units as necessary to provide time-current curve shaping to achieve long time trip indicated on drawings, inrush coordination and damage protection.
- E. Circuit breakers rated 1200A and above:
1. Circuit breakers rated 1200A and above, not specified elsewhere with zone selective interlocking, shall be provided with an energy reducing maintenance switch with local status indicator.
  2. The switch and status indicators shall be remote from the circuit breaker, located at the entrance to the electrical room where the circuit breaker is installed.

## 2.5 INSTRUMENTATION

- A. Instrument Transformers: NEMA EI 21.1, IEEE C57.13, and the following:
1. Potential Transformers: Secondary voltage rating of 120 V and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
  2. Current Transformers: Ratios shall be as indicated with accuracy class and burden suitable for connected relays, meters, and instruments.
  3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kV.
- B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
    - a. Phase Currents, Each Phase: Plus or minus 1 percent.
    - b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
    - c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
    - d. Megawatts: Plus or minus 2 percent.
    - e. Megavars: Plus or minus 2 percent.
    - f. Power Factor: Plus or minus 2 percent.
    - g. Frequency: Plus or minus 0.5 percent.
    - h. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from 5 to 60 minutes.
    - i. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent. Accumulated values unaffected by power outages up to 72 hours.

2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

## 2.6 CONTROL POWER

- A. Control Circuits: 120 V, supplied through secondary disconnecting devices from control-power transformer.
- B. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.
- C. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

## 2.7 ACCESSORY COMPONENTS AND FEATURES

- A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Provide permanent provisions for locking all overcurrent devices in switchboard. Provisions shall remain in place whether or not lock is installed.
- C. Furnish portable test set to test functions of solid-state trip devices without removal from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.
- D. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.

## PART 3 - EXECUTION

### 3.1 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

### 3.2 EXAMINATION

- A. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 INSTALLATION

- A. Install switchboards and accessories according to NEMA PB 2.1 and NECA 40.

- B. Install switchboards and anchor to concrete bases according to utility or manufacturer's recommendations, seismic codes at Project, and requirements in Division 26 Section "Hangers and Supports for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.
- D. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.
- E. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.
  - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- F. Install spare-fuse cabinet.

### 3.4 ADJUSTING

- A. Adjust circuit breaker trip and time delay settings to values as instructed by the Engineer.

### 3.5 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification."
- B. Switchboard Nameplates: Label each switchboard compartment with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

### 3.6 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- B. Testing: Perform the following field quality control tests in accordance with Division 26 section "Electrical Testing."
  - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Sections 7.1, 7.5, 7.6, 7.9, 7.10, 7.11, and 7.14 as appropriate. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Perform the following infrared scan tests and inspections and prepare reports:
  - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
  - b. Instruments, Equipment, and Reports:
    - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    - 2) Prepare a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.7 CLEANING

- A. On completion of installation, inspect interior and exterior of switchboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

### 3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories.

END OF SECTION 262413

SECTION 262416 - PANELBOARDS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. AFCI: Arc-fault circuit interrupter.

- E. RFI: Radio-frequency interference.
- F. RMS: Root mean square.
- G. SPDT: Single pole, double throw.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, surge protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Related Submittals:
  - 1. Provide overcurrent device coordination study to demonstrate proper overcurrent device ratings, adjustments, and settings.
- C. Shop Drawings: For each panelboard and related equipment.
  - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details for types other than NEMA 250, Type 1.
    - b. Bus configuration, current, and voltage ratings.
    - c. Short-circuit current rating of panelboards and overcurrent protective devices.
    - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 2. Wiring Diagrams: Power, signal, and control wiring.
- D. Field quality-control test reports including the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1, include the following:
  - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

## 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with NEMA PB 1.
- F. Comply with NFPA 70.

## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
  - 1. Ambient Temperature: Not exceeding 104 deg F.
  - 2. Altitude: Not exceeding 6600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
  - 1. Ambient temperatures within limits specified.
  - 2. Altitude not exceeding 6600 feet.
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of electrical service.
  - 2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

## 1.7 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and

other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

## 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- 1. Keys: Six spares for each type of panelboard cabinet lock.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
  - a. Eaton Corporation; Cutler-Hammer Products.

### 2.2 MANUFACTURED UNITS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

- B. Enclosures: Mounting as noted on panel schedules. NEMA PB 1, Type 1.

- 1. Rated for environmental conditions at installed location.
  - a. Outdoor Locations: NEMA 250, Type 3R.
  - b. Other Wet or Damp Indoor Locations: NEMA 250, Type 4X.
- 2. Cabinet Front: Flush or surface cabinet as noted on the Drawings.
  - a. Eaton LTDD (Piano hinge trim)
  - b. GE - FGB (front hinge to box).
  - c. Square D - Continuous piano hinge trim.
  - d. Siemens - Figure 4 hinge to box w/piano hinge.
- 3. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
- 4. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.

- C. Phase and Ground Buses:



1. Material: Aluminum.
  2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- D. Conductor Connectors: Suitable for use with conductor material.
1. Main and Neutral Lugs: Mechanical type.
  2. Ground Lugs and Bus Configured Terminators: Compression type.
  3. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
  4. Double Lugs: Mechanical type mounted at location of main incoming lugs.
- E. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- F. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
- G. Surge Protective Devices: Where indicated, provide manufactured units with direct bus connected type as specified in Division 26 Section "Surge Protective Devices."
1. Provide Surge Protective Device for all Distribution and Branch Circuit Panelboards that are part of the Emergency Distribution System.
  2. Provide Surge Protective Devices elsewhere where indicated on the drawings.
- 2.3 PANELBOARD SHORT-CIRCUIT RATING
- A. Fully rated to interrupt symmetrical short-circuit current available at terminals.
- 2.4 DISTRIBUTION PANELBOARDS
- A. Main bus bars, neutral and ground, shall be aluminum and sized in accordance with U.L. Standards to limit temperature rise on any current carrying part to the maximums as indicated in UL67.
- B. Doors: Secured with vault-type latch with tumbler lock; keyed alike. Omit for fused-switch panelboards.
- C. Main Overcurrent Protective Devices: Circuit breaker.
- D. Branch Overcurrent Protective Devices:
1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
  2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
  3. Fused switches.
- 2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS
- A. Main bus bars, neutral and ground, shall be sized in accordance with U.L. Standards to limit temperature rise on any current carrying part to the maximums as indicated in UL67.

- B. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

## 2.6 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: NEMA AB 3, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits.
    - a. Circuit Breakers 250A and Larger: Magnetic trip element with front-mounted, field-adjustable trip setting with restricted access cover.
  - 2. Electronic trip-unit circuit breakers shall have RMS sensing; field-replaceable rating plug; and with the following field-adjustable settings with restricted access cover:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and I<sup>2</sup>t response.
  - 3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  - 4. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
  - 5. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
  - 6. AFCI Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
  - 1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
  - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
  - 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  - 4. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
  - 5. Shunt Trip: 120-V trip coil energized from separate circuit.
  - 6. Do not use tandem circuit breakers.
  - 7. Provide lock on devices for circuit breakers when called out on panel schedules with "LOD" designation.
  - 8. Provide type GFEP circuit breakers for all self-regulating heating (snow melting and heat trace) cables branch circuits and where noted on panel schedules with "GFEP" designation

9. Provide GFCI circuit breaker when called out on panel schedules with "GFCI" designation.
10. Provide Arc-Fault Circuit Interrupters where indicated on panel schedule with "AFCI" designation.
11. Provide shunt trip breakers when called out on panel schedules with "STB" designation.
12. Provide smart controllable circuit breakers when called out on panel schedules with "SMT" designation.
13. Provide permanent padlockable handle for circuit breakers when called out on panel schedules with "PL" designation.

C. Circuit Breaker Selection for Transformer Primary Protection:

1. Circuit Breaker Selection for Transformer Primary Protection: Provide circuit breakers with time-current characteristics to clear transformer inrush currents while still providing protection for the ANSI through-fault protection curve. Provide circuit breakers with adjustable magnetic trip or electronic trip units as necessary to provide time-current curve shaping to achieve long time trip indicated on drawings, inrush coordination and damage protection.

## 2.7 ACCESSORY COMPONENTS AND FEATURES

- A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Provide permanent provisions for padlocking all overcurrent devices in Distribution Panelboards. Provisions shall remain in place whether or not lock is installed.
- C. Provide permanent provisions for padlocking overcurrent devices in Branch Circuit Panelboards that serve equipment not provided with a local, lockable disconnecting means. Provisions shall remain in place whether or not lock is installed

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- C. Mount top of trim 74 inches above finished floor, unless otherwise indicated.
- D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Install overcurrent protective devices and controllers.
  1. Set field-adjustable switches and circuit-breaker trip ranges.

- F. Install filler plates in unused spaces.
- G. Stub four 1-inch empty conduits from recessed panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- H. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

### 3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads or created by retrofitting. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable. Coordinate final directory room names and numbers with Owner.
- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

### 3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding."
- B. Connect wiring according to Division 26 Section "Conductors and Cables."

### 3.4 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- B. Testing: Perform the following field quality control tests in accordance with Division 26 section "Electrical Testing"
  - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters. Perform electrical tests on all breakers and switches 200A and above or that constitute a component of an emergency distribution system. Main circuit breakers in branch circuit panelboards 225A and below are not required to be tested.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
  - 1. Measure as directed during period of normal system loading.
  - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
  - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
  - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
  
- D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scanning of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.
  - 1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - 2. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
  
- E. Testing and Certification (Isolation Power Panels)
  - 1. Provide manufacturer's engineer or technician for final testing of Isolated Power Panel and the related system as follows.
    - a. Simulate faults at each receptacle to ascertain correct function of the L.I.M.
    - b. Check the calibration of the L.I.M. meter and record readings.
    - c. Record and date all data in permanent log book.
    - d. Certify that the system is properly installed and in correct working order.
    - e. Turn over to the hospital maintenance department a set of test equipment consisting of a ground integrity tester, current leakage tester, and plug in the L.I.M. tester.

### 3.5 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Single and duplex receptacles
  - 2. Receptacles with integral USB charger.
  - 3. Ground-fault circuit interrupter receptacles
  - 4. Controlled receptacles.
  - 5. Single- and double-pole snap switches.
  - 6. Device wall plates.
  - 7. Pin and sleeve connectors and receptacles.
  - 8. Floor service fittings

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.

- C. AFCI: Arc-fault circuit interrupter.
- D. PVC: Polyvinyl chloride.
- E. RFI: Radio-frequency interference.
- F. SPD: Surge protective devices.
- G. UTP: Unshielded twisted pair.
- H. USB: Universal serial bus.

#### 1.4 REFERENCES

- A. DSCC W-C-596G: Federal Specification Connector, Electrical, Power, General Specification.
- B. DSCC W-C-896F: Federal Specification Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification).
- C. IEC 309-1, Part 1: General Requirements: Plugs, Socket-Outlets and Couplers for Industrial Purposes
- D. NEMA FB 11: Plugs, Receptacles, and Connectors of the Pin and Sleeve Type for Hazardous Locations.
- E. NEMA WD 1: General Requirements for Wiring Devices.
- F. NEMA WD 6: Wiring Device – Dimensional Requirements.
- G. UL 20: General-Use Snap Switches.
- H. UL 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- I. UL 498: Electrical Attachment Plugs and Receptacles.
- J. UL 943: Ground Fault Circuit Interrupters.
- K. NECA 130-2010: Installing and Maintaining Wiring Devices.

#### 1.5 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations for each type of product indicated.

#### 1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and source.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

## 1.7 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  - 1. Cord and Plug Sets: Match equipment requirements.

## PART 2 - PRODUCTS

### 2.1 GENERAL WIRING DEVICE REQUIREMENTS

- A. Comply with NFPA 70, NEMA WD 1, NEMA WD 6, and UL498.
- B. Devices for Owner-Furnished Equipment:
  - 1. Receptacles: Match plug configurations.
  - 2. Cord and Plug Sets: Match equipment requirements.
- C. Device Color:
  - 1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
  - 2. Wiring Devices Connected to Emergency Power System: Red.
  - 3. Wiring Devices Connected to Optional Standby Power System: Red.
  - 4. Wall Switches: As selected by Architect, unless otherwise indicated.

### 2.2 INDUSTRIAL-GRADE RECEPTACLES

- A. Duplex Receptacle, NEMA 5-20R:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hubbell Wiring Device-Kellems: HBL 5362
    - b. Eaton/Arrow Hart Wiring Devices: AH5362
    - c. Leviton: 5362
    - d. Legrand, Pass & Seymour: 5362A
- B. Industrial Heavy-Duty Pin and Sleeve Devices: Comply with IEC 309-1.

### 2.3 GFCI RECEPTACLES

- A. General:
  - 1. Comply with UL 943



B. Duplex GFCI Receptacle, NEMA 5-20R:

1. Manufacturers: Subject to compliance with requirements, provide one of the following:
  - a. Hubbell Wiring Device-Kellems: GFRST20
  - b. Eaton/Arrow Hart Wiring Devices: SGF20
  - c. Leviton: GFNT2
  - d. Legrand, Pass & Seymour: 2097

C. Tamper-Resistant Duplex GFCI Receptacle, NEMA 5-20R:

1. Safety mechanism to energize contacts only when both openings are simultaneously engaged.
2. Manufacturers: Subject to compliance with requirements, provide one of the following:
  - a. Hubbell Wiring Device-Kellems: GFTRST20
  - b. Eaton/Arrow Hart Wiring Devices: TRSGF20
  - c. Leviton: GFTR2
  - d. Legrand, Pass & Seymour: 2097TR

D. Tamper- and Weather-Resistant Duplex GFCI Receptacle, NEMA 5-20R:

1. Safety mechanism to energize contacts only when both openings are simultaneously engaged.
2. Manufacturers: Subject to compliance with requirements, provide one of the following:
  - a. Hubbell Wiring Device-Kellems: GFTWRST20
  - b. Eaton/Arrow Hart Wiring Devices: TWRSGF20
  - c. Leviton: GFWT2
  - d. Legrand, Pass & Seymour: 2097TRWR

E. Weather-Resistant Duplex GFCI Receptacle, NEMA 5-20R:

1. Comply with UL 943.
2. Manufacturers: Subject to compliance with requirements, provide one of the following:
  - a. Eaton/Arrow Hart Wiring Devices WRSGF20
  - b. Leviton: GFWR2
  - c. Legrand, Pass & Seymour: 2097TRWR

2.4 STRAIGHT BLADE AND TWIST-LOCK RECEPTACLES, OTHER THAN NEMA 5-20R

- A. Provide commercial specification grade straight blade and twist-lock receptacles with standard NEMA configurations in accordance with the "Special Receptacles" schedule included on the drawings.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Hubbell Wiring Device-Kellems
  2. Eaton/Arrow Hart Wiring Devices

3. Leviton
4. Legrand, Pass & Seymour

## 2.5 PENDANT CORD-CONNECTOR DEVICES

- A. Description: Matching, locking type plug and receptacle body connector, NEMA WD 6, device configurations as indicated on drawings, heavy-duty grade.
- B. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
- C. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

## 2.6 CORD AND PLUG SETS

- A. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
- B. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
- C. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

## 2.7 WALL SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Hubbell Wiring Device-Kellems: 1220 Series
  2. Eaton/Arrow Hart Wiring Devices: AH1220 Series
  3. Leviton: 1220 Series
  4. Legrand, Pass & Seymour: PS20AC Series
- B. Device body: Plastic handle.
- C. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.
- D. Snap Switches: Heavy Duty specification grade, quiet type; rated 20A., 120-277 V AC.
- E. Provide single-pole, two-pole, three-way and four-way switches as indicated.
- F. Provide pilot light where indicated. Switch shall be illuminated when the switch is on.
- G. Provide key type where indicated. Furnish four keys to Owner.
- H. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.
  1. Switch: 20 A, 120/277-V ac.

2. Receptacle: NEMA WD 6, Configuration 5-20R.

## 2.8 WALL PLATES

### A. Manufacturers:

1. Provide wall plates and corresponding wiring devices from same manufacturer.

### B. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces:
  - a. 0.035-inch-thick, satin-finished stainless steel
3. Material for Unfinished Spaces:
  - a. Galvanized steel
4. Material for Wet Locations: Gasketed Cast aluminum with hinged cover and listed and labeled as Extra Duty Weatherproof While-In-Use.
  - a. Manufacturers:
    - 1) Red Dot Model: CKLSVU, Thomas & Betts
    - 2) Intermatic: WP3110MXD
    - 3) Leviton: IUM1V
5. Material for Damp Locations: Gasketed Cast aluminum with hinged cover and listed and labeled as Weatherproof.
  - a. Manufacturers:
    - 1) Red Dot Model CCGV, ABB Installation Products
    - 2) Eaton/Arrow Hart WLRD1
    - 3) Legrand, Pass & Seymour
    - 4) Intermatic: WP3110MXD

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Prior to installation of devices, verify wall openings are neatly cut and will be completely covered by wall plates, clean debris from outlet boxes and provide extension rings to bring outlet boxes flush with finished surface.
- C. Install devices and assemblies level, plumb, and square with building lines.
- D. Arrangement of Devices:

1. Coordinate locations of outlet boxes provided under Division 26 Section "Raceways and Boxes" to obtain mounting heights indicated on Drawings.
  2. Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top.
  3. Where multiple switches, dimmers, and/or occupancy sensors are adjacent to each other, provide a single cover plate. Custom fabricate, if required, for all combinations. Provide separate boxes or barriers as required for the application.
  4. Install horizontally mounted receptacles with grounding pole on the left.
  5. Install GFCI receptacles so that the "Push To Test" and "Reset" designations can be read correctly. If printed in both directions, install with ground pole on top.
  6. Install switches with OFF position down.
- E. Install cover plates on switch, receptacle, and blank outlets in finished areas.
- F. Install weather-resistant type receptacles in all damp and wet locations, including pool environments.
- G. Install weatherproof cover plates on receptacles in damp locations.
- H. Install weatherproof While-In-Use cover plates on receptacles in wet locations.
- I. Install tamper-resistant type receptacles in all locations as required by the NEC (406.12) and as indicated on plan.
- J. Provide hospital-grade tamper-resistant receptacles in all areas where identified in the National Electrical Code (406.12(s) and 517.18(c)) (i.e., business offices, corridors, waiting areas, lobbies, exam rooms, pediatric patient rooms, etc.).
- K. Use oversized plates for outlets installed in masonry walls.
- L. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- M. Remove wall plates and protect devices and assemblies during painting.
- N. Install properly oriented access floor boxes into cutouts in access floor tiles and secure to tiles per Manufacturer's instructions.
- O. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.
- P. Adjust devices and wall plates to be flush and level. Three corners of wall plates must be in contact with wall surfaces. Devices shall be solidly mounted against the box.

### 3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Electrical Identification."
1. Receptacles: Identify panelboard and circuit number from which served. Use adhesive label as specified in Division 26 Section "Electrical Identification" with black-filled lettering on face of wall plate, and durable wire markers or tags inside outlet boxes.

2. Wall Switches: Identify panelboard and circuit number from which served. Use adhesive label as specified in Division 26 Section "Electrical Identification" with black-filled lettering on face of wall plate, and durable wire markers or tags inside outlet boxes.

### 3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding." Connect wiring device grounding terminal to outlet box with bonding jumper. Use of quick ground strap or screw is not acceptable.
- B. Connect wiring according to Division 26 Section "Conductors and Cables." Connect wiring devices by wrapping conductor around screw terminal or by using back wiring and tightening the screw securely.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  1. Inspect each wiring device for defects.
  2. Operate each wall switch with circuit energized and verify proper operation.
  3. After installing wiring devices and after electrical circuitry has been energized, test each receptacle for proper polarity, ground continuity, and compliance with requirements.
  4. Test each GFCI receptacle for proper operation with both local and remote fault simulations according to manufacturer's written instructions.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 262726

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Cartridge fuses rated 600 V and less for use in switches and controllers.
  - 2. Spare-fuse cabinets.

1.3 SUBMITTALS

- A. Product Data: Include the following for each fuse type indicated:
  - 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
  - 2. Let-through current curves for fuses with current-limiting characteristics.
  - 3. Time-current curves, coordination charts and tables, and related data.
  - 4. Fuse size for elevator feeders and elevator disconnect switches.
- B. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
  - 1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
  - 2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

- C. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Division 1 Section "Closeout Procedures," include the following:
    - a. Let-through current curves for fuses with current-limiting characteristics.
    - b. Time-current curves, coordination charts and tables, and related data.
    - c. Ambient temperature adjustment information.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with:
  - 1. NEMA FU 1 - Low Voltage Cartridge Fuses.
  - 2. NFPA 70 - National Electrical Code.
  - 3. UL 198C - High-Interrupting-Capacity Fuses, Current-Limiting Types.
  - 4. UL 198E - Class R Fuses.
  - 5. UL 512 - Fuseholders.

#### 1.5 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

#### 1.6 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

#### 1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Quantity equal to 10% percent of each fuse type and size, but no fewer than 3 of each type and size.

### PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. [Cooper Bussmann, Inc.](#)
  2. [Eagle Electric Mfg. Co., Inc.](#); Cooper Industries, Inc.
  3. [Ferraz Shawmut, Inc.](#)
  4. Tracor, Inc.; [Littelfuse, Inc.](#) Subsidiary.

## 2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.
1. Service Entrance: Class T, fast acting.
  2. Feeders: Class RK5, time delay.
  3. Motor Branch Circuits: Class RK5, time delay.
  4. Other Branch Circuits: Class RK5, time delay.

## 2.3 SPARE-FUSE CABINET

- A. Cabinet: Wall-mounted, 0.05-inch-thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
1. Size: 30 inches high by 24 inches wide by 12 inches deep.
  2. Finish: Gray, baked enamel.
  3. Identification: "SPARE FUSES" in 1-1/2-inch-high letters on exterior of door.
  4. Fuse Pullers: For each size of fuse.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Fuses shall be shipped separately. Any fuses shipped installed in equipment, shall be replaced by the Electrical Contractor with new fuses as specified above prior to energization at no additional expense to Owner. All fuses shall be stored in moisture free packaging at job site and shall be installed immediately prior to energization of the circuit in which it is applied.



- B. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- C. Install spare-fuse cabinet(s).

### 3.3 IDENTIFICATION

- A. Install labels indicating fuse rating and type on outside of the door on each fused switch.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 26 Section "Fuses".

1.2 SUMMARY

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Molded-case circuit breakers.
  - 4. Molded-case switches.
  - 5. Enclosures.
- B. Related Sections:

1. Division 26 "Hangers and Supports for Electrical Systems" for concrete bases.

### 1.3 DEFINITIONS

- A. GD: General duty.
- B. GFCI: Ground-fault circuit interrupter.
- C. HD: Heavy duty.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.

### 1.4 REFERENCES

- A. NECA 1: Practices for Good Workmanship in Electrical Contracting.
- B. NETA ATS: Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- C. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. NEMA AB 1: Molded Case Circuit Breakers and Molded Case Switches.
- E. NEMA FU 1: Low Voltage Cartridge Fuses.
- F. NEMA KS 1: Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- G. NEMA PB1.1: General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
- H. NEMA PB2.1: General Instructions for Proper Installation, Operation, and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.
- I. NFPA 70: National Electrical Code.

### 1.5 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
  1. Enclosure types and details for types other than NEMA 250, Type 1.
  2. Current and voltage ratings.
  3. Short-circuit current rating.
  4. UL listing for series rating of installed devices.
  5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- B. Shop Drawings: Diagram power, signal, and control wiring.

- C. Qualification Data: For testing agency.
- D. Field quality-control test reports including the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Manufacturer's field service report.
- F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Closeout Procedures," include the following:
  - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
  - 2. Time-current curves, including selectable ranges for each type of circuit breaker.

#### 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.
- D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
  - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
  - 2. Altitude: Not exceeding 6600 feet.

## 1.8 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

## 1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Spares: For the following:
    - a. Potential Transformer Fuses: 2 of each size and type.
    - b. Control-Power Fuses: 2 of each size and type
    - c. Fuses for Fusible Switches: Equal to 10 percent of amount installed for each size and type, but no fewer than 3 of each size and type.
  - 2. Spare Indicating Lights: Six of each type installed.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Manufacturers:
  - 1. Eaton Corporation; Cutler-Hammer Products.
- B. Fusible Switch: NEMA KS 1, quick make, quick-break load interrupter enclosed knife switch Type HD, with clips or bolt pads to accommodate specified fuses, externally operable lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Nonfusible Switch: NEMA KS 1, quick make, quick-break load interrupter enclosed knife switch Type HD, externally operable lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Accessories:
  - 1. Provide early break auxiliary contacts in motor disconnect switches for motors that are fed from variable frequency controllers.

2. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
3. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
4. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

## 2.3 TOGGLE DISCONNECT SWITCH

### A. Manufacturers:

1. Double Pole:
  - a. Hubbell 1372.
  - b. Leviton 6808G-DAC.
  - c. Pass & Seymour 7812.
  - d. Bryant 30102.
2. Three Pole:
  - a. Hubbell 1379.
  - b. Leviton 7810GD.
  - c. Pass & Seymour 7813.
  - d. Bryant 30103.

- B. Description: Heavy duty, 30A, 600 volt, double or three pole as required, single throw, motor rated switch without overload protection. Provide NEMA 1 enclosure and padlock attachment.

## 2.4 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

### A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Siemens Industries, Inc.
4. Square D/Group Schneider.

- B. Molded-Case Circuit Breaker: NEMA AB1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
  - a. Instantaneous trip.
  - b. Long- and short-time pickup levels.
  - c. Long- and short-time time adjustments.
  - d. Ground-fault pickup level, time delay, and I<sup>2</sup>t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
  5. GFCI Circuit Breakers: Single- and two-pole configurations with 5 or 30-mA trip sensitivity as required.
- C. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
1. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
  2. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
  3. Enclosure: Provide handle capable of being locked in the open position with padlock.
  4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  5. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
  6. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
  7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
  8. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
- D. Molded-Case Switches: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- E. Molded-Case Switch Accessories:
1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
  2. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.
  3. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage. Provide "dummy" trip unit where required for proper operation.
  4. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay. Provide "dummy" trip unit where required for proper operation.
  5. Key Interlock Kit: Externally mounted to prohibit operation; key shall be removable only when switch is in off position.
  6. Circuit breaker selection for primary
- F. Circuit Breaker Selection for Transformer Primary Protection: Provide circuit breakers with time-current characteristics to clear transformer inrush currents while still providing protection for the ANSI through-fault protection curve. Provide circuit breakers with adjustable magnetic trip or electronic trip units as necessary to provide time-current curve shaping to achieve long time trip indicated on drawings, inrush coordination and damage protection.

## 2.5 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
  - 1. Indoor Dry Locations: NEMA 250, Type 1.
  - 2. Outdoor Locations: NEMA 250, Type 3R.
  - 3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
  - 4. Other Wet or Damp Indoor Locations: NEMA 250, Type 4x.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 CONCRETE BASES

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 3.

### 3.3 INSTALLATION

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- C. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Install switches with off position down.
- E. Install NEMA KS 1 enclosed switch where indicated for motor loads  $\frac{1}{2}$  HP and larger and equipment loads greater than 30A.
- F. Install toggle disconnect switch, surface mounted, where indicated for motor loads less than  $\frac{1}{2}$  HP and equipment loads 30A. and less.
- G. Install fuses in fusible disconnect switches.
- H. Install flexible liquid tight conduit from toggle disconnect switch to portable equipment. Leave a 6'-0" whip.



- I. Install flexible liquid tight conduit from toggle disconnect switch to stationary equipment.
- J. Install control wiring from early break contacts in motor disconnect switch to variable frequency controllers to shut down controller when switch is open.
- K. Install equipment on exterior foundation walls at least one inch from wall to permit vertical flow of air behind breaker and switch enclosures.
- L. Support enclosures independent of connecting conduit or raceway system.
- M. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

### 3.4 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Electrical Identification."
- C. Provide adhesive label as specified in Division 26 Section "Electrical Identification" on inside door of each switch indicating UL fuse class and size for replacement.

### 3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance testing as follows:
  - 1. Inspect mechanical and electrical connections.
  - 2. Verify switch and relay type and labeling verification.
  - 3. Verify rating of installed fuses.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- C. Perform the following field tests and inspections and prepare test reports:
  - 1. Test mounting and anchorage devices according to requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
  - 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches. Certify compliance with test parameters.
  - 3. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.6 for molded-case circuit breakers. Test all NEMA AB1, molded case circuit breakers with thermal magnetic trip or auxiliary, solid-state trip units 100A and larger. Certify compliance with test parameters.
    - a. Visual and Mechanical Inspection
      - 1) Circuit breaker shall be checked for proper mounting and compare nameplate data to Drawings and Specifications.
      - 2) Operate circuit breaker to ensure smooth operation.
      - 3) Inspect case for cracks or other defects.
      - 4) Check internals on unsealed units.

b. Electrical Tests

- 1) Perform a contact resistance test.
- 2) Perform an insulation resistance test at 1000 volts dc from pole-to-pole and from each pole-to-ground with breaker closed and across open contacts of each phase.
- 3) Perform long time delay time-current characteristic tests by passing three hundred percent (300%) rated current through each pole separately. Record trip time. Make external adjustments as required to meet time current curves.
- 4) Determine short time pickup and delay by primary current injection.
- 5) Determine ground fault pickup and time delay by primary current injection.
- 6) Determine instantaneous pickup current by primary injection using run-up or pulse method.
- 7) Perform adjustments for final settings in accordance with coordination study.
- 8) For circuit breakers 800A and larger, verify all functions of trip unit by means of secondary injection in lieu of primary injection.

c. Test Values

- 1) Compare contact resistance or millivolt drop values to adjacent poles and similar breakers. Investigate deviations of more than fifty percent (50%). Investigate any value exceeding manufacturer's recommendations.
- 2) Insulation resistance shall not be less than 100 megohms.
- 3) Trip characteristic of breakers shall fall within manufacturer's published time-current characteristic tolerance band, including adjustment factors.
- 4) All trip times shall fall within N.E.T.A. Acceptance Testing Specifications, Table 10.7 Circuit breakers exceeding specified trip time at three hundred percent (300%) of pickup shall be tagged defective.
- 5) Instantaneous pickup values shall be within values shown on N.E.T.A. Acceptance Testing Specifications, Table 10.8 or manufacturer's recommendations.

4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

### 3.6 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip and time delay settings to values as determined by the protective device coordination study.

### 3.7 CLEANING

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
- B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 262816

SECTION 262913 - ENCLOSED CONTROLLERS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes ac, enclosed controllers rated 600 V and less, of the following types:
  - 1. Across-the-line, manual and magnetic controllers.
  - 2. Reduced-voltage controllers.
  - 3. Multispeed controllers.
- B. Related Sections include the following:
  - 1. Division 26 Section "Electrical Power Monitoring and Control" for interfacing communication and metering requirements.

2. Division 20 Section "Variable Frequency Controllers" for general-purpose, ac, adjustable-frequency, pulse-width-modulated controllers for use on constant torque loads in ranges up to 200 hp.
3. Division 26 "Hangers and Supports for Electrical Systems" for concrete bases.

### 1.3 SUBMITTALS

- A. Product Data: For each type of enclosed controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each enclosed controller.
  1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Each installed unit's type and details.
    - b. Nameplate legends.
    - c. Short-circuit current rating of integrated unit.
    - d. UL listing for series rating of overcurrent protective devices in combination controllers.
    - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices in combination controllers.
  2. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around enclosed controllers where pipe and ducts are prohibited. Show enclosed controller layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
- D. Qualification Data: For manufacturer and testing agency.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Closeout Procedures," include the following:
  1. Routine maintenance requirements for enclosed controllers and all installed components.
  2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
- G. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

### 1.4 REFERENCES

- A. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

- B. ANSI/UL 198C - High-Intensity Capacity Fuses; Current-Limiting Types.
- C. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.
- D. FS W-F-870 - Fuseholders (For Plug and Enclosed Cartridge Fuses).
- E. FS W-S-865 - Switch, Box, (Enclosed), Surface-Mounted.
- F. NECA 402-2000 - Recommended Practice for Installing and Maintaining Motor Control Centers.
- G. NEMA AB 1 - Molded Case Circuit Breakers.
- H. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
- I. NEMA KS 1 - Enclosed Switches.
- J. ANSI/NFPA 70 - National Electrical Code.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- C. Source Limitations: Obtain enclosed controllers of a single type through one source from a single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with NFPA 70.
- F. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed controllers, minimum clearances between enclosed controllers, and for adjacent surfaces and other items. Comply with indicated maximum dimensions and clearances.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prior to beginning work on any system, verify all existing conditions that affect the work and coordinate with all other trade Contractors. Determine that the work can be

installed as indicated or immediately report to the Architect/Engineer errors, inconsistencies or ambiguities.

- B. Deliver products to site under provisions of Section 260010. Store and protect products under provisions of Section 260010.
- C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle in accordance with manufacturer's written instructions. Lift large equipment only with lugs provided for the purpose. Handle carefully to avoid damage to motor control center components, enclosure, and finish.
- E. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install electric heating of sufficient wattage to prevent condensation.

#### 1.7 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of each contactor and indicate circuits controlled. Submit under provisions of 26 0010.

#### 1.8 COORDINATION

- A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."
- D. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.
- E. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

#### 1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Spare Fuses: Furnish one spare for every five installed, but no fewer than one set of three of each type and rating.

2. Indicating Lights: Two of each type installed.
3. Keys: Furnish 2 of each to Owner.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. [Eaton Corporation; Cutler-Hammer Products.](#)

### 2.2 ACROSS-THE-LINE ENCLOSED CONTROLLERS

- A. Manual Controller: NEMA ICS 2, general purpose, Class A, with "quick-make, quick-break" toggle or pushbutton action, and marked to show whether unit is "OFF," "ON," or "TRIPPED."

1. Overload Relay: Ambient-compensated type with inverse-time-current characteristics and NEMA ICS 2, Class 10 tripping characteristics. Relays shall have heaters and sensors in each phase, matched to nameplate, full-load current of specific motor to which they connect and shall have appropriate adjustment for duty cycle.

- B. Magnetic Controller: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated.

1. Control Circuit: 120 V; obtained from integral control power transformer with sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.
2. Adjustable Overload Relay: Dip switch selectable for motor running overload protection with NEMA ICS 2, Class 20 tripping characteristic, and selected to protect motor against voltage and current unbalance and single phasing. Provide relay with Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.

- C. Combination Magnetic Controller: Factory-assembled combination controller and disconnect switch.

1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by an NRTL.
2. Nonfusible Disconnecting Means: NEMA KS 1, heavy-duty, nonfusible switch.
3. Circuit-Breaker Disconnecting Means: NEMA AB 1, motor-circuit protector with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.

### 2.3 VARIABLE FREQUENCY CONTROLLERS

- A. Refer to Division 20 "Variable Frequency Controllers."
- B. Equipment furnished by mechanical trades and installed by electrical trades.

## 2.4 ENCLOSURES

- A. Description: Flush- or surface-mounting cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at installed location.
  - 1. Outdoor Locations: NEMA 250, Type 3R.
  - 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
  - 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
  - 4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

## 2.5 ACCESSORIES

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Push-Button Stations, Pilot Lights: NEMA ICS 2, heavy-duty type.
- C. Indicating Lights: Run (Red), off or ready (Green).
- D. Auxiliary Contacts: Provide two normally open (N.O.) and two normally closed (N.C.) contacts.
- E. Selector Switch: NEMA ISC 2, mounted in front cover to read "hand/off/auto," provide auxiliary contact for auto position monitoring.
- F. Control Relays: Auxiliary and adjustable time-delay relays.
- G. Elapsed Time Meters: Heavy duty with digital readout in hours.
- H. Meters: Panel type, 2-1/2-inch minimum size with 90- or 120-degree scale and plus or minus 2 percent accuracy. Where indicated, provide transfer device with an off position. Meters shall indicate the following:
  - 1. Ammeter: Output current, with current sensors rated to suit application.
  - 2. Voltmeter: Output voltage.
  - 3. Frequency Meter: Output frequency.
- I. Multifunction Digital-Metering Monitor: UL-listed or -recognized, microprocessor-based unit suitable for three- or four-wire systems and with the following features:
  - 1. Inputs from sensors or 5-A current-transformer secondaries, and potential terminals rated to 600 V.
  - 2. Switch-selectable digital display of the following:
    - a. Phase Currents, Each Phase: Plus or minus 1 percent.
    - b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
    - c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
    - d. Three-Phase Real Power: Plus or minus 2 percent.
    - e. Three-Phase Reactive Power: Plus or minus 2 percent.
    - f. Power Factor: Plus or minus 2 percent.
    - g. Frequency: Plus or minus 0.5 percent.
    - h. Integrated Demand with Demand Interval Selectable from 5 to 60 Minutes: Plus or minus 2 percent.
    - i. Accumulated energy, in megawatt hours (joules), plus or minus 2 percent; stored values unaffected by power outages for up to 72 hours.



3. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.
- J. Phase-Failure and Undervoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable undervoltage setting.
- K. Current-Sensing, Phase-Failure Relays for Bypass Controllers: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage; with adjustable response delay.
- L. Manufacturer provided nameplate shall be provided on controller enclosure. Nameplate shall contain the following information:
  1. Manufacturer's name or identification.
  2. Voltage rating.
  3. Current and/or horsepower rating.
  4. Short-circuit current rating,

## 2.6 FACTORY FINISHES

- A. Finish: Manufacturer's standard gray paint applied to factory-assembled and -tested enclosed controllers before shipping.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and surfaces to receive enclosed controllers for compliance with requirements, installation tolerances, and other conditions affecting performance.
  1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLICATIONS

- A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, controller, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.

### 3.3 INSTALLATION

- A. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."
- B. Install freestanding equipment on concrete bases.

- C. Comply with mounting and anchoring requirements specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- D. Enclosed Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 26 Section "Fuses."
- E. Install motor control equipment and contactors in accordance with manufacturer's instructions.
- F. Select and install heater elements in motor starters to match installed motor characteristics.
- G. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

### 3.4 CONCRETE BASES

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 3.

### 3.5 IDENTIFICATION

- A. Identify enclosed controller, components, and control wiring according to Division 26 Section "Electrical Identification."

### 3.6 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers according to Division 26 Section "Conductors and Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect hand-off-automatic switch and other automatic-control devices where applicable.
  - 1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
  - 2. Connect selector switches with enclosed controller circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

### 3.7 CONNECTIONS

- A. Conduit installation requirements are specified in other Division 26 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding."

### 3.8 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each enclosed controller element, bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
  
- B. Testing: Perform the following field quality control tests in accordance with Division 26 section "Electrical Testing"
  - 1. Perform each electrical test and visual and mechanical inspection, except optional tests, stated in NETA ATS. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

### 3.9 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

### 3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 262913

SECTION 264113 - LIGHTNING PROTECTION

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Contractor sections, apply to work of this section.
- B. Related Sections include the following:
  - 1. Division 26 Section "Electrical General Requirements."

1.2 GENERAL REQUIREMENTS

- A. Provide a complete lightning protection system including all labor, materials and installation as specified herein.
- B. The entire system shall be aluminum and shall be installed as a concealed system as required.
- C. Installers of system shall be registered with Underwriters' Laboratories and certified by the Lightning Protection Institute.
- D. The entire system shall be installed in accordance with Underwriter's Laboratories Standard UL 96-A, NFPA-780, and LPI-175. Upon completion of installation deliver to the Architect/Engineer, for the Owner, the UL Master Label Certificate or LPI-IP Certificate.
- E. The installation of this system shall be subcontracted in its entirety, by the Electrical Contractor to a fully qualified Lightning Protection Contractor having no less than five years of continuous experience in this area, and being able to certify his having made installations similar to this and of this size or larger and shall submit a list of similar buildings on which he has installed a Master Label Lightning Protection system that has been inspected and certified by U.L. or LPI-IP, within the past five years.

### 1.3 REFERENCES

- A. ANSI/NFPA 780 - Standard for the Installation of Lightning Protection Systems.
- B. ANSI/UL 96 - Lightning Protection Components.
- C. LPI-175 - Lightning Protection Institute.
- D. UL 96A - Installation Requirements for Lightning Protection Systems.

### 1.4 SUBMITTALS

- A. Submit shop Drawings and product data under provisions of Section 260100.
- B. Submit shop Drawings showing layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.
- C. Submit product data showing dimensions and materials of each component, and include indication of listing in accordance with ANSI/UL 96.

### 1.5 PROJECT RECORD DOCUMENTS

- A. Submit project record documents under provisions of Section 260100.
- B. Accurately record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors.

### 1.6 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with other building systems and components to insure a correct, neat and unobtrusive installation.
- B. Coordinate installation of through roof assemblies and air terminals fastened to roofing systems with roofing contractor.
- C. Final flashes of through roof assemblies, and all specialty roof products necessary for the preservation of manufacturer's warranty such as heat welds or slip sheets if required, shall be supplied and installed by the roofing contractor per roofing manufacturer's specifications.

## PART 2 - PRODUCTS

### 2.1 STANDARD

- A. All equipment used in this installation shall be UL inspected, approved, and properly labeled.

- B. All equipment shall be of a design and construction to suit the application where it is used, in accordance with accepted industry standards, specifically NFPA-780, UL96-A, and LPI-175 code requirements.

## 2.2 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the indicated Thompson Lightning Protection, Inc. (901 Sibley Hwy., St. Paul, MN 55118; 800 777-1230; TLP@TLPInc.com) product or a comparable product by one of the following:
  - 1. East Coast Lightning Equipment (24 Lanson Dr., Winstead, CT 06098; 888 680-9462; Info@ECLE.biz.)
  - 2. HLP Systems, Inc. (426 North Ave. Libertyville, IL 60048; 800 510-0229; Info@HLPSystems.com).
  - 3. ALT Fabrication (122 Leesley Ln, Argyle, TX 76226; 800 950-7960; Sales@ALTFab.com)

## 2.3 GENERAL

- A. Ground rods shall be copper clad minimum 5/8 inches by 10 feet, Thompson #225, or approved equal.
- B. Cable to ground rod connector shall be heavy duty cast copper bronze, Thompson #231, or approved equal.
- C. Connecting cable from steel column to ground rod shall be heavy duty Class II Copper cable, Thompson #28R, exothermic or approved equal.
- D. Bonding plates used to connect ground cable to steel columns shall be heavy duty with a minimum bonding surface or 8 square inches, Thompson #586, or approved equal.
- E. Copper air terminals shall be minimum 10 inches long, 1/2 inch diameter base, solid copper with nickel chrome plate finish, blunt tip Thompson 55BT, or approved equal.
- F. Cable to ground rod connector shall be heavy duty cast copper bronze, Thompson #230, or approved equal.
- G. Aluminum air terminals shall be a minimum 10 inches long, 1/2 inches diameter base, solid aluminum blunt tip, Thompson A55BT or approved equal.
- H. "Through the roof" connectors shall be solid brass or stainless steel rods with vice grip connectors at each end housed in 1-1/2 inch Schedule 40 PVC; connectors shall be adjustable for roof thickness, Thompson #709, or approved equal.
- I. Roof Conductors - Copper conductor cable shall be 32 strands of 17 gauge, 99.97% pure copper wires, smooth twist, braided basket weave center with a minimum weight of 230 pounds per 1000 feet, Thompson #32S, or approved equal.

### PART 3 - EXECUTION

#### 3.1 INSTALLERS

- A. Guardian Equipment Company (www.GuardianEquipment.com; Info@GuardianEquipment.com).
- B. HLP Systems, Inc. (www.HLPSystems.com; Info@HLPSystems.com).
- C. Michigan Lightning Protection, Inc. (www.MichiganLightning.com; MichiganLightning@SBCGlobal.net).

#### 3.2 INSTALLATION

- A. Lightning Protection Contractor shall provide, design and install the entire system, furnishing all labor, materials and equipment, incidental thereto for a complete and functional installation.
- B. This is a structural steel building and the structural steel framework shall be utilized as the main down conductors of the lightning protection system. The use of cable down conductors will not be permitted.
- C. Grounding of the steel columns around the perimeter of the building shall average not over 60 feet apart and in no case shall the distance between any two such grounds exceed 66 feet.
- D. Connections between ground rods and structural steel columns shall be made with heavy duty Class II copper conductor.
- E. This is a poured concrete and/or masonry building. The use of reinforcing rods in lieu of cable down conductors will not be permitted. However, at least one continuous vertical run of reinforcing rods shall be bonded at both top and bottom to each down cable. All cable imbedded in poured concrete or masonry shall be copper.
- F. If down conductor cables are run in conduit, the conduit shall be bonded to the down conductor cable at both top and bottom
- G. Copper down conductors to ground installed around the perimeter of the building shall average not over 100 feet apart, and in no case shall the distance between any two such grounds exceed 100 feet apart.
- H. Ground rods shall be electrically driven to a minimum of 12 feet below grade level and shall be driven vertically with no slant permitted without specific approval of the Architect/Engineer.
- I. All connections, except where otherwise specifically approved or accepted, shall be bronze bolt and nut clamps.
- J. Spacing between air terminals shall not exceed 20 feet.
- K. Where the building exceeds 50 feet in width, provide center roof protection.

- L. Approved thru-roof assemblies only with solid bronze or stainless steel rods shall be allowed to penetrate the roof. In no instance shall cable conductor be allowed to penetrate the roof. Final flashings of thru-roof assemblies, and all specialty roof products necessary for the preservation of manufacturer's warranty such as heat welds or slip sheets if required, shall be supplied and installed by the roofing contractor per roofing manufacturer's specifications.
- M. All mechanical and electrical equipment on the roof shall be bonded to the lightning protection system as required.
- N. Wherever vents, ducts, exhausts, and motorized vents made of aluminum are to be bonded to a copper system, a proper aluminum to copper connector shall be used.
- O. In no case shall metal copings of fasciae be substituted for the main roof conductor. However, such metal copings or fasciae shall be bonded to the main roof conductor with an approved connector at intervals not exceeding 100 feet apart.
- P. It is intended that this shall be a complete and functional Lightning Protection system and anything necessary to accomplish this is to be provided as if herein written. All work shall be installed in a neat and workmanlike manner and in accordance with the latest standards of the industry.
- Q. Per NFPA 780 any building over 60' above grade shall have a counterpoise loop installed using a #4/0 bare copper cable, or Thompson #28R, connected to the lightning protection ground rods. (Spacing of ground rods shall not exceed 100').

### 3.3 FIELD QUALITY CONTROL

- A. Obtain the services of Underwriters Laboratories, Inc. or LI-IP to provide inspection and certification of the lightning protection system under provisions of UL 96A, NFPA 780, and LPI-175.
- B. Obtain UL Master Label or LPI-IP certificate and deliver to Owner upon completion.

END OF SECTION 264113



SECTION 265119 - LED INTERIOR LIGHTING

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

- 1. Interior solid-state luminaires that use LED technology.
- 2. Lighting fixture supports.

B. Related Requirements:

- 1. Division 26 "Lighting Control Devices."

2. Division 26 "Relay-Based Lighting Control"
3. Division 26 "Dimming Controls"

### 1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. Lamp: LED and substrate as a replaceable assembly.
- F. LED: Light-emitting diode.
- G. Lumen: Measured output of lamp and luminaire, or both.
- H. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

### 1.4 SUBMITTALS

- A. Product Data: For each type of product.
  1. Arrange in order of luminaire designation.
  2. Include data on features, accessories, and finishes.
  3. Include physical description and dimensions of luminaires.
  4. Include emergency lighting units, including batteries and chargers.
  5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
  6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project per IES LM-79 and IES LM-80.
    - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products or certified by a qualified independent testing agency.
- B. Shop Drawings: For nonstandard or custom luminaires.
  1. Include plans, elevations, sections, and mounting and attachment details.
  2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  3. Include diagrams for power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  1. Lighting luminaires.

2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
4. Structural members to which equipment and or luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including the following:
  - a. Other luminaires.
  - b. Air outlets and inlets.
  - c. Speakers.
  - d. Sprinklers.
  - e. Access panels.
  - f. Ceiling-mounted projectors.
  - g. Moldings.

- D. Qualification Data: For testing laboratory providing photometric data for luminaires.
- E. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- F. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.
- G. Sample warranty.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
  1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. LED Boards: 5% attic stock of each type and rating installed. Furnish at least one of each type.
  2. LED Drivers 5% attic stock of each type and rating installed. Furnish at least one of each type.
  3. Diffusers and Lenses: 1% attic stock of each type and rating installed. Furnish at least one of each type.
  4. Globes and Guards: 5% attic stock of each type and rating installed. Furnish at least one of each type.

#### 1.7 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- C. Provide luminaires from a single manufacturer for each luminaire type.
- D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Comply with:
  - 1. NFPA 70 - National Electrical Code.
  - 2. NECA/IESNA 500-1998 - Recommended Practice for Installing Indoor Commercial Lighting Systems.
  - 3. NECA/IESNA 502-1999 - Recommended Practice for Installing Industrial Lighting Systems.
  - 4. Code of Federal Regulations (47 CFR 37342).
  - 5. Michigan Department of State Police, Fire Marshall Division Policy Number 11-06 "Plastic Materials as Interior Finishes" pertaining to the use of plastic lenses in lighting fixtures for health care facilities.
  - 6. Michigan Department of Community Industry Services requirements that all lamps shall be protected from breakage. Exposed lamps are not acceptable.
- G. FMG Compliance: Fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.
- H. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

#### 1.9 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

#### 1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) or manufacturer's standard warranty length (whichever is longer) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 LUMINAIRES (LIGHTING FIXTURES)

- A. Provide Luminaires as included in specification 26 5700 "Luminaire Product Data." This section contains product data sheets from the basis of design manufacturer with annotations.
- B. Acceptable alternate manufacturers are indicated on the product data sheets. Alternate manufacturer products shall be equal in all respects including materials, finishes, photometric performance and energy performance and shall include all options, features, and accessories identified.
- C. The Luminaire schedule shown on the drawings is supplemental provided for convenience and reference only. The requirements of this section and 26 5700 shall govern.

### 2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. Unless otherwise specified in Luminaire product data, provide products with a minimum CRI as noted.
- E. Unless otherwise specified in Luminaire product data, provide products with a CCT as noted.
- F. Unless otherwise specified in Luminaire product data, provide products with an IES LM-80 rated lamp life of 50,000 hours.
- G. Driver
  - 1. Provided as an integrated component of the luminaire or as an external component of an assembly of luminaries.
  - 2. Nominal Input Voltage: All drivers shall be rated for use on either 120V or 277V systems.

### 2.3 EXIT SIGNS

- A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
  - 1. Lamps: Light-emitting diodes, 70,000 hours minimum of rated lamp life.

- C. Provide edge lit signs with a mirror plaque background.

## 2.4 EMERGENCY LIGHTING UNITS

- A. General: Self-contained units complying with UL 924.
  - 1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
  - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
  - 3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
  - 4. Wire Guard: Where indicated, heavy-chrome-plated wire guard protects lamp heads or fixtures.

## 2.5 EMERGENCY AUTOMATIC LOAD CONTROL RELAY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Bodine BLCD Series.
  - 2. Nine-24, Inc.: ELCR Series.
  - 3. LVS, EPC Series
  - 4. IOTA, ETS-20 Series
  - 5. Functional Devices, Inc., ESR Series
  - 6. ETC, ALCR Series
  - 7. Wattstopper, ELCU series
- B. Description:
  - 1. The Automatic Load Control Relay (ALCR) shall provide required functionality to allow any standard lighting control device to control emergency lighting in conjunction with normal lighting in any area of the building.
  - 2. The ALCR shall allow control of emergency lighting fixtures in tandem with normal lighting in an area while ensuring that emergency lighting will turn on immediately to full brightness upon loss of normal power supplying the control device.
  - 3. Emergency lighting operation shall be independent for each controlled area and shall not require a generalized power failure for proper operation.
  - 4. Self-contained with integral ½" nipple mount with snap in locking feature for mounting into a standard junction box knock out.
  - 5. Normally closed dry contacts capable of switching 20 amp emergency ballast loads @ 120-277 VAC, 60 Hz, or 10 amp tungsten loads @ 120 VAC, 60 Hz.
  - 6. Universal rated voltage inputs provided for normal power sense and normal switched power at 120-277 VAC, 60 Hz.
  - 7. Integral momentary test switch. Pressing and holding this switch shall instantly force the unit into emergency mode and turn on emergency lighting. Releasing the test switch shall immediately return the unit to normal operation.
  - 8. Dedicated leads and 24 VDC source for connection to remote test switch, fire alarm system, or other external system capable of providing a normally closed dry contact closure. Breaking contact between the terminals shall force and hold the emergency lighting on until the terminals are again closed. An integral LED indicator shall indicate the unit's current remote activation status.

9. Separate LEDs to indicate the presence of normal and emergency power sources. The LEDs shall indicate the unit's current operational mode (normal or emergency).
  10. Normal power input leads shall be connected to the line side of the control device such that any upstream fault causing a loss of power, including the tripping of the branch circuit breaker, will force the unit into the emergency mode and turn on the emergency lighting.
  11. Automatically switch emergency lighting on and off as normal lighting is switched. When normal power is not available, the unit shall force and hold emergency lighting on regardless of the state of any external control device until normal power is restored.
  12. Utilize zero crossing circuitry to protect relay contacts from inrush current.
  13. Plenum rated housing equipped with compression flying leads.
  14. The unit shall be UL listed to the UL924 standard and labeled for connection to both normal and emergency lighting power sources.
- C. Provide device with proper rating for total load and load type being transferred
- D. Provide for devices suitable for line voltage and low voltage dimming control where required such that device bypasses dimming control signal to luminaire to provide full output upon loss of normal power.
- E. Coordinate with luminaire product data, lighting control schedules and details and diagrams included on the drawings for dimming characteristics.

## 2.6 BRANCH CIRCUIT EMERGENCY LIGHTING TRANSFER SWITCH

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. LVS EPC-D-F-ATS Series
  2. Bodine.
- B. Description: Localized load transfer switch to allow emergency fixture to be powered and controlled by the normal lighting circuit, sense presence of normal power ahead of control circuit and switch luminaire (both line and neutral) over to emergency source upon loss of normal source.
- C. Universal dimming capability to allow the lighting to be controlled and dimmed by the normal lighting circuit during normal times. In the event of a loss of the normal branch circuit, and transfer the designated emergency fixtures from normal dimming control to the emergency power source and bring them to full brightness, regardless of the current state of the dimming system.
- D. Device shall be mounted remotely for each control circuit as application requires.
- E. Listed and labeled by an NRTL to the UL1008 for emergency operation and listed for field installation.
- F. Integral test switch and indicating lamps to indicate status.
- G. Provide device with proper rating for total load and load type being transferred
- H. Coordinate with luminaire product data, lighting control schedules and details and diagrams included on the drawings.

## 2.7 MATERIALS

### A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

### B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

### C. Diffusers and Globes:

1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

### D. Factory-Applied Labels: Comply with UL 1598 Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:
  - a. "USE ONLY" and include specific lamp type.
  - b. Lamp diameter, shape, size, wattage, and coating.
  - c. CCT and CRI for all luminaires.

## 2.8 METAL FINISHES

### A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

## 2.9 LUMINAIRE FIXTURE SUPPORT COMPONENTS

### A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

### B. Single-Stem Hangers: Unless otherwise specified in Luminaire product data, provide products with a minimum 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

### C. Wires: Unless otherwise specified in Luminaire product data, provide products with a minimum ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.

### D. Rod Hangers: Unless otherwise specified in Luminaire product data, provide products with a minimum 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.



- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 TEMPORARY LIGHTING

- A. Do not use permanent luminaires for temporary lighting.

#### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and N.E.C.A./I.E.S.N.A. 500-2006 and 502-2006.
- B. Locate ceiling luminaires as indicated on reflected ceiling plan.
- C. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.
  - 1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from fixture corners.
  - 2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
  - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
- D. Support luminaires independent of ceiling framing. Support recessed grid luminaires from two opposite corners directly to structure. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- E. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure.
- F. Install recessed luminaires to permit removal from below.
- G. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- H. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

- I. Install fixture with no gaps between adjacent fixtures or between fixtures and surrounding surfaces. Trims of fixtures shall be properly and uniformly aligned.
  - J. Supports:
    - 1. Sized and rated for luminaire weight.
    - 2. Able to maintain luminaire position after cleaning.
    - 3. Provide support for luminaire without causing deflection of ceiling or wall.
    - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
  - K. Flush-Mounted Luminaire Support:
    - 1. Secured to outlet box.
    - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
    - 3. Trim ring flush with finished surface.
  - L. Wall-Mounted Luminaire Support:
    - 1. Attached to structural members in walls.
    - 2. Do not attach luminaires directly to gypsum board.
  - M. Ceiling-Mounted Luminaire Support:
    - 1. As noted.
  - N. Suspended Luminaire Support:
    - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
    - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
    - 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing, rod, or wire support for suspension for each unit length of luminaire chassis, including one at each end.
    - 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
  - O. Comply with requirements in Section 260519 "Conductors and Cables" for wiring connections.
  - P. Fixtures shall have their exterior labels removed and shall be thoroughly cleaned.
  - Q. Locate the remote test/monitor modules identically so that they are visible and they form a straight line when viewed from the end of the corridor or room. Where a suspended ceiling exists, center the modules in adjacent ceiling tiles.
- 3.4 CONNECTIONS
- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

- B. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- C. Bond products and metal accessories to branch circuit equipment grounding conductor.
- D. Connect luminaires to branch circuit outlet boxes provided under Division 26 Section "Raceways and Boxes" using 1/2" flexible conduit.

### 3.5 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.
- D. A visual inspection shall be performed to verify cleanliness and alignment of the fixtures, misalignment and light leaks shall be corrected, and rattles due to ventilation system vibration shall be eliminated.

### 3.7 STARTUP SERVICE

- A. Comply with requirements for startup specified in Section 260943.23 "Relay-Based Lighting Controls."

### 3.8 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps, drivers, or luminaires that are defective.
  2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  3. Adjust the aim of luminaires in the presence of the Architect.
- B. Adjust exit sign directional arrows as indicated on Drawings.
- C. Adjust and calibrate all dimming system controls until the system works as designed. Contact the Architect/Engineer when dimming is complete and demonstrate operation to owner's representative and Architect/Engineer.

### 3.9 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosures and lenses.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

END OF SECTION 265119

SECTION 265600 - EXTERIOR LIGHTING

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

- 1. Exterior luminaires with lamps and ballasts.
- 2. Luminaire-mounted photoelectric relays.
- 3. Poles and accessories.
- 4. Luminaire lowering devices.

- B. Related Sections include the following:

- 1. Division 26 Section "LED Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

### 1.3 DEFINITIONS

- A. CRI: Color-rendering index.
- B. Luminaire: Complete lighting fixture, including ballast housing if provided.
- C. Pole: Luminaire support structure, including tower used for large area illumination.
- D. Standard: Same definition as "Pole" above.

### 1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4.
- B. Live Load: Single load of 500 lbf, distributed as stated in AASHTO LTS-4.
- C. Ice Load: Load of 3 lbf/sq. ft., applied as stated in AASHTO LTS-4.
- D. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4.
  - 1. Wind speed for calculating wind load for poles exceeding 50 feet in height is 110 mph.
  - 2. Wind speed for calculating wind load for poles 50 feet or less in height is 110 mph.

### 1.5 SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
  - 2. Details of attaching luminaires and accessories.
  - 3. Details of installation and construction.
  - 4. Luminaire materials.
  - 5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
    - a. Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
  - 6. Photoelectric relays.
  - 7. Lamps, including life, output, and energy-efficiency data.
  - 8. Materials, dimensions, and finishes of poles.
  - 9. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
  - 10. Anchor bolts for poles.
  - 11. Manufactured pole foundations.

- B. Shop Drawings:
  - 1. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
  - 2. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
  - 3. Wiring Diagrams: Power and control wiring.
- C. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4 and that load imposed by luminaire has been included in design.
- D. Qualification Data: For agencies providing photometric data for lighting fixtures.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.
- G. Warranty: Special warranty specified in this Section.

#### 1.6 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with IEEE C2, "National Electrical Safety Code."
- E. Comply with NFPA 70.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Package aluminum poles for shipping according to ASTM B 660.
- B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
- C. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

#### 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that

fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period.

1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
4. Warranty Period for Light fixture: Replace LED boards and drivers that fail within 24 months from date of Substantial Completion; furnish.
5. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

## 1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. LED Boards: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
  2. Glass and Plastic Lenses, Covers, and Other Optical Parts: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
  3. LED Drivers: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
  4. Globes and Guards: 10 for every 20 of each type and rating installed. Furnish at least one of each type.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
  2. Basis of Design Product: The design of each item of exterior luminaire and its support is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

### 2.2 LUMINAIRES, GENERAL REQUIREMENTS

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
- B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.



- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
- J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
  - 1. White Surfaces: 85 percent.
  - 2. Specular Surfaces: 83 percent.
  - 3. Diffusing Specular Surfaces: 75 percent.
- K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
  - 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
    - a. Color: As selected by Architect from manufacturer's standard catalog of colors.
- N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax, or as noted.
  - a. Color: As noted.

## 2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

- A. Comply with UL 773 or UL 773A.
- B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.
  1. Relay with locking-type receptacle shall comply with NEMA C136.10.
  2. Adjustable window slide for adjusting on-off set points.

## 2.4 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

- A. Structural Characteristics: Comply with AASHTO LTS-4.
  1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in Part 1 "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3.
  2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
- B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.
- C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
  1. Materials: Shall not cause galvanic action at contact points.
  2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated.
  3. Anchor-Bolt Template: Plywood or steel.
- D. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete."
- E. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.

- F. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4.

## 2.5 ALUMINUM POLES

- A. Poles: Seamless, extruded structural tube complying with ASTM B 429, Alloy 6063-T6 with access handhole in pole wall.
- B. Poles: ASTM B 209, 5052-H34 marine sheet alloy with access handhole in pole wall.
  - 1. Shape: Round, tapered.
  - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- D. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- E. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
  - 1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.
  - 2. Finish: Same as pole.
- F. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- G. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
  - 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
  - 3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
  - 4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
    - a. Color: As selected by Architect from standard colors.

## 2.6 POLE ACCESSORIES

- A. Duplex Receptacle: 120 V, 20 A in a weatherproof assembly complying with Division 26 Section "Wiring Devices" for ground-fault circuit-interrupter type.
  - 1. Recessed, 12 inches above finished grade.
  - 2. With cord opening.
  - 3. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.
- B. Minimum 1800-W transformer, protected by replaceable fuses, mounted behind access cover.
- C. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.
- D. Transformer Type Base: Same material and color as pole. Coordinate dimensions to suit pole's base flange and accept indicated accessories.
- E. Vibration Dampener: For all steel and aluminum lighting poles taller than 25', provide factory installed vibration dampening device to eliminate second mode or higher resonance that can occur with low velocity steady state winds.
- F. Decorative accessories, supplied by decorative pole manufacturer, include the following:
  - 1. Banner Arms: As noted

## 2.7 REQUIREMENTS FOR INDIVIDUAL EXTERIOR LIGHTING DEVICES

- A. Refer to light fixture product data

## PART 3 - EXECUTION

### 3.1 LUMINAIRE INSTALLATION

- A. Install exterior lighting system per N.E.C.A./I.E.S.N.A. 501-2006.
- B. Install lamps in each luminaire.
- C. Fasten luminaire to indicated structural supports.
  - 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- D. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

### 3.2 POLE INSTALLATION

- A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features, unless otherwise indicated on Drawings:
  - 1. Fire Hydrants and Storm Drainage Piping: 60 inches.
  - 2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet.
  - 3. Trees: 15 feet
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 3 Section "Cast-in-Place Concrete."
- D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
  - 1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
  - 2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
  - 3. Install base covers, unless otherwise indicated.
  - 4. Use a short piece of 1/2-inch-diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- E. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
  - 1. Dig holes large enough to permit use of tampers in the full depth of hole.
  - 2. Backfill in 6-inch layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.
- F. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
  - 1. Make holes 6 inches in diameter larger than pole diameter.
  - 2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi at 28 days, and finish in a dome above finished grade.
  - 3. Use a short piece of 1/2-inch-diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
  - 4. Cure concrete a minimum of 72 hours before performing work on pole.
- G. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch-wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch below top of concrete slab.
- H. Raise and set poles using web fabric slings (not chain or cable).

### 3.3 BOLLARD LUMINAIRE INSTALLATION

- A. Align units for optimum directional alignment of light distribution.
- B. Install on concrete base with top 4 inches above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 3 Section "Cast-in-Place Concrete."

### 3.4 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

- A. Install on concrete base with top 4 inches above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 3 Section "Cast-in-Place Concrete."

### 3.5 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Division 26 Section "Raceways and Boxes." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

### 3.6 GROUNDING

- A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding."
- B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding."

### 3.7 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
  - 1. Verify operation of photoelectric controls.
- C. Illumination Tests:
  - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):
    - a. IESNA LM-5, "Photometric Measurements of Area and Sports Lighting."
    - b. IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
    - c. IESNA LM-52, "Photometric Measurements of Roadway Sign Installations."
    - d. IESNA LM-64, "Photometric Measurements of Parking Areas."
    - e. IESNA LM-72, "Directional Positioning of Photometric Data."
- D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 265600

**TYPE L1**  
 Other Manufacturers:  
 Paco Lighting MRGA2 Series  
 Cooper Lighting Fail-Safe FSR Series  
 New Star Lighting 57R Series

**HIGH ABUSE**  
**HASEDI SERIES – LED – INSET DOOR**

**PRODUCT FEATURES:**

- » High-output lamp sources for accurate color rendition and lighting performance
- » Diffused high-efficiency lens for reduced glare
- » Recessed ceiling mount, grid or flange - 1'x4', 2'x2', 2'x4'
- » Suitable for universal installation into 1.0" and 1.5" grid or flange (drywall) ceilings
- » One-piece inset doorframe, secured to housing with continuous piano hinge and Torx® fasteners
- » Peace of Mind Guarantee® against breakage



**SPECIFICATIONS**

**HOUSING:** 20-gauge CRS. Hole-free, one-piece, seam-welded construction. Integral aluminum heat sink for thermal dissipation. 18-gauge housing flange with mitered and welded corners. White TGIC polyester powder coat finish – 5-step pre-treatment. Salt spray test: 1,000 hours; Reflectance: 92%.

**DOORFRAME:** 18-gauge CRS. One-piece inset construction welded corners. White TGIC polyester powder coat – 5-stage pre-treatment. Salt spray test: 1,000 hours; Reflectance: 92%. Lens frame secured to housing with continuous hinge and 3 tamper-resistant stainless steel Torx® with center pin fasteners.

**LENS:** See Lens Options below to specify lens material. Lens sealed to doorframe with silicone sealant and secured with continuous lens retention system. Lens orientation – smooth side out. Minimum .187" polycarbonate lens required (max. .375") for Peace of Mind Guarantee®.

**ELECTRICAL:** Available 3000K, 3500K, 4000K and 5000K color temperatures. 120-277VAC and 347VAC, 50/60Hz electrical input with serviceable high power factor electronic, constant-current driver (<20% THD, >0.95 PF). Standard 0-10V dimming with 1-100% range and dim-to-dark capabilities (non dim-to-dark with 347V); 660 µA maximum source current.

**SENSOR & CONTROLS:** Optional sensor available with compatible third party controls. To see the full list of compatible controls, [click here](#).

**INSTALLATION:** Adjustable swing-out mounting brackets standard.

**PHOTOMETRICS:** Photometry tested to the IESNA LM-79-08 standard. For additional photometric data, please go to [www.kenall.com](http://www.kenall.com)

**WARRANTY:** Limited five (5) year LED warranty. [Peace of Mind Guarantee against breakage](#).

**LISTINGS:** Luminaire is certified to UL standards by Intertek Testing Laboratory for non-IC and Wet Location installations. ETL certified IP65 per IEC60598. CCEA approved.



**ORDERING INFORMATION (Ex: HASEDI-24-67L-40K8-DIM1-DV-2F-2H-SYM/9)**

Model	Size	Lamp Power	Lamp Color	Driver	Voltage	Doorframe	Housing	Lens Type	Options	
<b>HASEDI</b>										
<b>Size</b>										
14	1'x4'									
22	2'x2'									
24	2'x4'									
<b>Lamp Power</b>										
		1'x4'								
		45L†	45 Watt LED							
		67L	67 Watt LED							
		90L	90 Watt LED							
		2'x2'								
		45LD	45 Watt Dual-Row LED							
		67L	67 Watt LED							
		90L	90 Watt LED							
		2'x4'								
		45LD	45 Watt Dual-Row LED							
		67L	67 Watt LED							
		90L	90 Watt LED							
		135L	135 Watt LED							
		180L	180 Watt LED							
<b>Lamp Color</b>										
		30K8	3000K / 82 CRI min.							
		35K8	3500K / 82 CRI min.							
		40K8	4000K / 82 CRI min.							
		50K8	5000K / 82 CRI min.							
<b>Driver Type</b>										
				<b>DIM1</b>						
				DIM1 0-10V Dimming to 1%						
<b>Voltage</b>										
				<b>DV</b>						
				DV 120-277VAC, 50/60Hz						
				<b>120</b>						
				120 120VAC						
				<b>277</b>						
				277 277VAC						
				<b>347</b>						
				347 347VAC						
<b>Doorframe Options</b>										
				<b>2F</b>						
				2F 18-Ga CRS in Gloss White (STD)						
				<b>3F</b>						
				3F 20-Ga Type 304 SS with 48 Brushed Finish						
<b>Housing/Flange Options</b>										
				<b>2H</b>						
				2H 20-Ga CRS/18-Ga CRS in Gloss White (STD)						
				<b>5H5</b>						
				5H5 20-Ga Type 304 SS/18-Ga Type 304 SS with 48 Brushed Finish						
				<b>2H5</b>						
				2H5 20-Ga CRS/18-Ga Type 304 SS with 48 Brushed Finish						
<b>Lens Type</b>										
				<b>G</b>						
				G .187" #12 Prismatic Polycarbonate						
				<b>SYM/9</b>						
				SYM/9 Symmetric, Diffused DR Acrylic inside lens .250" Clear Polycarbonate outside lens						
				<b>SL</b>						
				SL Specified Lens						

\* Add .375" to ceiling cut out dimensions  
 † Only available when installed in drywall ceilings (flange mount)  
 • Voltage specific selection required  
 ‡ n/a with 2C Option  
 ▲ n/a with 180L lamp option or 347V input; voltage-specific selection required and height of fixture is 5.875" when specified with 135L lamp option; 0°C/32°F min. operating environment.



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For additional photometry, go to [www.kenall.com](http://www.kenall.com)

**HIGH ABUSE**  
**HASEDI SERIES – LED – INSET DOOR**

PERFORMANCE		Initial Delivered Lumens		Input Power (W)	Drive Current (mA)	Estd. L70 LED Life (Hrs)
Model	Lamp Type	@ 25°C	Efficacy (lm/W)			
HASEDI14	45L-30K8	4,480	97	46	100	80,000
	45L-35K8	4,633	100			
	45L-40K8	4,776	103			
	45L-50K8	4,967	108			
	67L-30K8	6,862	95	72	75	80,000
	67L-35K8	7,096	99			
	67L-40K8	7,316	102			
	67L-50K8	7,608	106			
	90L-30K8	8,818	90	98	100	60,000
	90L-35K8	9,119	93			
90L-40K8	9,401	96				
90L-50K8	9,777	100				
HASEDI22	45LD-30K8	4,633	100	47	100	80,000
	45LD-35K8	4,792	103			
	45LD-40K8	4,940	106			
	45LD-50K8	5,137	110			
	67L-30K8	7,098	99	72	75	80,000
	67L-35K8	7,340	102			
	67L-40K8	7,567	105			
	67L-50K8	7,869	109			
	90L-30K8	9,120	93	98	100	60,000
	90L-35K8	9,431	96			
90L-40K8	9,723	99				
90L-50K8	10,112	103				
HASEDI24	45LD-30K8	5,602	123	45	50	100,000
	45LD-35K8	5,793	128			
	45LD-40K8	5,972	132			
	45LD-50K8	6,211	137	72	75	80,000
	67L-30K8	8,184	114			
	67L-35K8	8,464	118			
	67L-40K8	8,725	121			
	67L-50K8	9,074	126	94	100	60,000
	90L-30K8	10,517	112			
	90L-35K8	10,876	116			
	90L-40K8	11,212	120			
	90L-50K8	11,660	125	147	100	60,000
	135L-30K8	14,908	101			
	135L-35K8	15,417	105			
	135L-40K8	15,894	108			
	135L-50K8	16,529	112	196	100	60,000
	180L-30K8	20,328	104			
	180L-35K8	21,022	107			
180L-40K8	21,672	111				
180L-50K8	22,539	115				

Provided information includes SYM9 Lens Type. Information subject to change without notice. Visit [www.kenall.com](http://www.kenall.com) for IES files and additional information.



[www.kenall.com](http://www.kenall.com) | P: 800-4-Kenall | F: 262-891-9701 | 10200 55th Street Kenosha, Wisconsin 53144, USA

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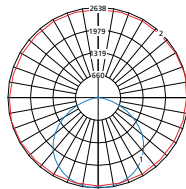
For additional photometry, go to [www.kenall.com](http://www.kenall.com)

**HIGH ABUSE**

**HASEDI SERIES – TECHNICAL DATA**

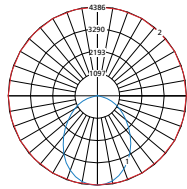
**PERFORMANCE**

Model: HASEDI-14-67L-40K8-DIM1-DV-2F-2H-SYM



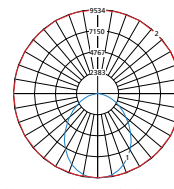
Maximum Candela = 2638 Located At Horizontal Angle = 15, Vertical Angle = 5  
 1 - Vertical Plane Through Horizontal Angles (15-195) (Through Max. Cd.)  
 2 - Horizontal Cone Through Vertical Angle (5) (Through Max. Cd.)

Model: HASEDI-22-90L-40K8-DIM1-DV-2F-2H-SYM



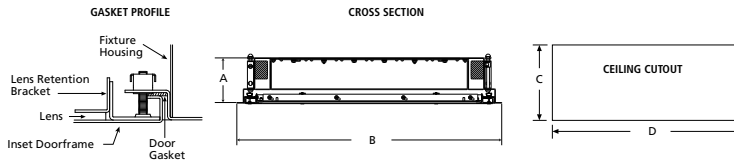
Max Candela = 4386 Located At Horizontal Angle = 0, Vertical Angle = 0  
 1 - Vertical Plane Through Horizontal Angles (0 - 180) (Through Max. Cd.)  
 2 - Horizontal Cone Through Vertical Angle (5) (Through Max. Cd.)

Model: HASEDI-24-180L-40K8-DIM1-DV-2F-2H-SYM



Max Candela = 9534 Located At Horizontal Angle = 0, Vertical Angle = 5  
 1 - Vertical Plane Through Horizontal Angles (0 - 180) (Through Max. Cd.)  
 2 - Horizontal Cone Through Vertical Angle (5) (Through Max. Cd.)

**DIMENSIONAL DATA**



**DIMENSIONAL DATA (IN INCHES)**

	A	B	C	D
1x4	4.20	11.75 x 47.75	10.85	46.85
2x2	4.20	23.75 x 23.75	22.85	22.85
2x4	4.20	23.75 x 47.75	22.85	46.85

\* Add .375" to ceiling cut out dimensions when IF Option is specified  
 \*\* Height is 5.875" with 135L lamp option when ordered in conjunction with LEL option.



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**TYPE L2**  
 Other Manufacturers:  
 Paco Lighting MRGA2 Series  
 Cooper Lighting Fail-Safe FSR Series  
 New Star Lighting 57R Series

**HIGH ABUSE**  
**HASEDI SERIES – LED – INSET DOOR**

**PRODUCT FEATURES:**

- » High-output lamp sources for accurate color rendition and lighting performance
- » Diffused high-efficiency lens for reduced glare
- » Recessed ceiling mount grid or flange - 1'x4', 2'x2', 2'x4'
- » Suitable for universal installation into 1.0" and 1.5" grid or flange (drywall) ceilings
- » One-piece inset doorframe, secured to housing with continuous piano hinge and Torx® fasteners
- » Peace of Mind Guarantee® against breakage



**SPECIFICATIONS**

**HOUSING:** 20-gauge CRS. Hole-free, one-piece, seam-welded construction. Integral aluminum heat sink for thermal dissipation. 18-gauge housing flange with mitered and welded corners. White TGIC polyester powder coat finish – 5-step pre-treatment. Salt spray test: 1,000 hours; Reflectance: 92%.

**DOORFRAME:** 18-gauge CRS. One-piece inset construction welded corners. White TGIC polyester powder coat – 5-stage pre-treatment. Salt spray test: 1,000 hours; Reflectance: 92%. Lens frame secured to housing with continuous hinge and 3 tamper-resistant stainless steel Torx® with center pin fasteners.

**LENS:** See Lens Options below to specify lens material. Lens sealed to doorframe with silicone sealant and secured with continuous lens retention system. Lens orientation – smooth side out. Minimum .187" polycarbonate lens required (max. .375") for Peace of Mind Guarantee®.

**ELECTRICAL:** Available 3000K, 3500K, 4000K and 5000K color temperatures. 120-277VAC and 347VAC, 50/60Hz electrical input with serviceable high power factor electronic, constant-current driver (<20% THD, >0.95 PF). Standard 0-10V dimming with 1-100% range and dim-to-dark capabilities (non dim-to-dark with 347V); 660 µA maximum source current.

**SENSOR & CONTROLS:** Optional sensor available with compatible third party controls. To see the full list of compatible controls, [click here](#).

**INSTALLATION:** Adjustable swing-out mounting brackets standard.

**PHOTOMETRICS:** Photometry tested to the IESNA LM-79-08 standard. For additional photometric data, please go to [www.kenall.com](#)

**WARRANTY:** Limited five (5) year LED warranty. [Peace of Mind Guarantee against breakage](#).

**LISTINGS:** Luminaire is certified to UL standards by Intertek Testing Laboratory for non-IC and Wet Location installations. ETL certified IP65 per IEC60598. CCEA approved.



**ORDERING INFORMATION (Ex: HASEDI-24-67L-40K8-DIM1-DV-2F-2H-SYM/9)**

Model	Size	Lamp Power	Lamp Color	Driver	Voltage	Doorframe	Housing	Lens Type	Options
<b>HASEDI</b>									
<b>Size</b>									
14	1'x4'	<b>Lamp Power</b>		<b>Driver Type</b>		<b>Options</b>			
22	2'x2'	1x4L	45 Watt LED	DIM1	0-10V Dimming to 1%	LEL* 8-4W Emergency Battery Pack			
24	2'x4'	45L†	45 Watt LED	<b>Voltage</b>		20KV 20KV/KA Surge Protection per			
		67L	67 Watt LED	DV	120-277VAC, 50/60Hz	IEEE/ANSI C62.41.2 Cat. A			
		90L	90 Watt LED	120	120VAC	FS Fuse & Holder			
		<b>2'x2'</b>		277	277VAC	HJ Sealed Wireway			
		45LD	45 Watt Dual-Row LED	347	347VAC	IF† Install Frame			
		67L	67 Watt LED	<b>Doorframe Options</b>		PF* Plaster Frame			
		90L	90 Watt LED	2F	18-Ga CRS in Gloss White (STD)	RF* Radio Frequency Filter			
		<b>2'x4'</b>		3F	20-Ga Type 304 SS with 48 Brushed Finish	RM† Continuous Row Mounting			
		45LD	45 Watt Dual-Row LED	<b>Housing/Flange Options</b>		TH 1/2" Trade Size Threaded Hub			
		67L	67 Watt LED	2H	20-Ga CRS/18-Ga CRS in Gloss White (STD)	2C Two Circuit Wiring			
		90L	90 Watt LED	5H5	20-Ga Type 304 SS/18-Ga Type 304 SS with 48 Brushed Finish	* Add .375" to ceiling cut out dimensions			
		135L	135 Watt LED	2H5	20-Ga CRS/18-Ga Type 304 SS with 48 Brushed Finish	† Only available when installed in drywall ceilings (flange mount)			
		180L	180 Watt LED	<b>Lens Type</b>		• Voltage specific selection required			
		<b>Lamp Color</b>		G	.187" #12 Prismatic Polycarbonate	‡ n/a with 2C Option			
		30K8	3000K / 82 CRI min.	SYM/9		▲ n/a with 180L lamp option or 347V input; voltage-specific selection required and height of fixture is 5.875" when specified with 135L lamp option; 0°C/32°F min. operating environment.			
		35K8	3500K / 82 CRI min.	SL		Specified Lens			
		40K8	4000K / 82 CRI min.						
		50K8	5000K / 82 CRI min.						



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For additional photometry, go to [www.kenall.com](http://www.kenall.com)

**HIGH ABUSE**  
**HASEDI SERIES – LED – INSET DOOR**

PERFORMANCE		Initial Delivered Lumens		Input Power (W)	Drive Current (mA)	Estd. L70 LED Life (Hrs)
Model	Lamp Type	@ 25°C	Efficacy (lm/W)			
HASEDI14	45L-30K8	4,480	97	46	100	80,000
	45L-35K8	4,633	100			
	45L-40K8	4,776	103			
	45L-50K8	4,967	108			
	67L-30K8	6,862	95	72	75	80,000
	67L-35K8	7,096	99			
	67L-40K8	7,316	102			
	67L-50K8	7,608	106			
	90L-30K8	8,818	90	98	100	60,000
	90L-35K8	9,119	93			
	90L-40K8	9,401	96			
	90L-50K8	9,777	100			
HASEDI22	45LD-30K8	4,633	100	47	100	80,000
	45LD-35K8	4,792	103			
	45LD-40K8	4,940	106			
	45LD-50K8	5,137	110			
	67L-30K8	7,098	99	72	75	80,000
	67L-35K8	7,340	102			
	67L-40K8	7,567	105			
	67L-50K8	7,869	109			
	90L-30K8	9,120	93	98	100	60,000
	90L-35K8	9,431	96			
	90L-40K8	9,723	99			
	90L-50K8	10,112	103			
HASEDI24	45LD-30K8	5,602	123	45	50	100,000
	45LD-35K8	5,793	128			
	45LD-40K8	5,972	132			
	45LD-50K8	6,211	137			
	67L-30K8	8,184	114	72	75	80,000
	67L-35K8	8,464	118			
	67L-40K8	8,725	121			
	67L-50K8	9,074	126			
	90L-30K8	10,517	112	94	100	60,000
	90L-35K8	10,876	116			
	90L-40K8	11,212	120			
	90L-50K8	11,660	125			
	135L-30K8	14,908	101	147	100	60,000
	135L-35K8	15,417	105			
	135L-40K8	15,894	108			
	135L-50K8	16,529	112			
	180L-30K8	20,328	104	196	100	60,000
	180L-35K8	21,022	107			
	180L-40K8	21,672	111			
	180L-50K8	22,539	115			

Provided information includes SYM9 Lens Type. Information subject to change without notice. Visit [www.kenall.com](http://www.kenall.com) for IES files and additional information.



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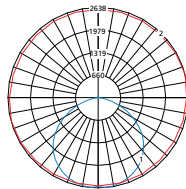
For additional photometry, go to [www.kenall.com](http://www.kenall.com)

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#### HASEDI SERIES – TECHNICAL DATA

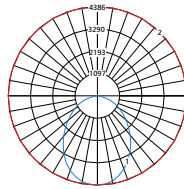
##### PERFORMANCE

Model: HASEDI-14-67L-40K8-DIM1-DV-2F-2H-SYM



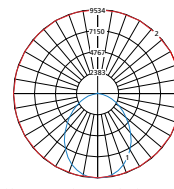
Maximum Candela = 2638 Located At Horizontal Angle = 15, Vertical Angle = 5  
 1 - Vertical Plane Through Horizontal Angles (15-195) (Through Max. Cd.)  
 2 - Horizontal Cone Through Vertical Angle (5) (Through Max. Cd.)

Model: HASEDI-22-90L-40K8-DIM1-DV-2F-2H-SYM



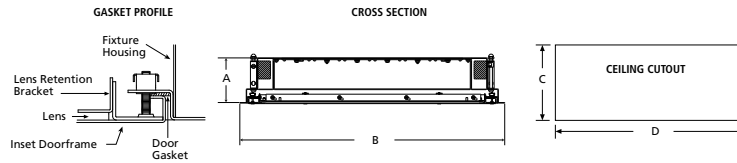
Max Candela = 4386 Located At Horizontal Angle = 0, Vertical Angle = 0  
 1 - Vertical Plane Through Horizontal Angles (0 - 180) (Through Max. Cd.)  
 2 - Horizontal Cone Through Vertical Angle (5) (Through Max. Cd.)

Model: HASEDI-24-180L-40K8-DIM1-DV-2F-2H-SYM



Max Candela = 9534 Located At Horizontal Angle = 0, Vertical Angle = 5  
 1 - Vertical Plane Through Horizontal Angles (0 - 180) (Through Max. Cd.)  
 2 - Horizontal Cone Through Vertical Angle (5) (Through Max. Cd.)

##### DIMENSIONAL DATA



##### DIMENSIONAL DATA (IN INCHES)

	A	B	C	D
1x4	4.20	11.75 x 47.75	10.85	46.85
2x2	4.20	23.75 x 23.75	22.85	22.85
2x4	4.20	23.75 x 47.75	22.85	46.85

\* Add .375" to ceiling cut out dimensions when IF Option is specified  
 \*\* Height is 5.875" with 135L lamp option when ordered in conjunction with LEL option.



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**TYPE L3**  
 Other Manufacturers:  
 Paco Lighting MRGA2 Series  
 Cooper Lighting Fail-Safe FSR Series  
 New Star Lighting 57R Series

**HIGH ABUSE**  
**HASEDI SERIES – LED – INSET DOOR**

**PRODUCT FEATURES:**

- » High-output lamp sources for accurate color rendition and lighting performance
- » Diffused high-efficiency lens for reduced glare
- » Recessed ceiling mount grid or flange - 1'x4', 2'x2', 2'x4'
- » Suitable for universal installation into 1.0" and 1.5" grid or flange (drywall) ceilings
- » One-piece inset doorframe, secured to housing with continuous piano hinge and Torx® fasteners
- » Peace of Mind Guarantee® against breakage



**SPECIFICATIONS**

**HOUSING:** 20-gauge CRS. Hole-free, one-piece, seam-welded construction. Integral aluminum heat sink for thermal dissipation. 18-gauge housing flange with mitered and welded corners. White TGIC polyester powder coat finish – 5-step pre-treatment. Salt spray test: 1,000 hours; Reflectance: 92%.

**DOORFRAME:** 18-gauge CRS. One-piece inset construction welded corners. White TGIC polyester powder coat – 5-stage pre-treatment. Salt spray test: 1,000 hours; Reflectance: 92%. Lens frame secured to housing with continuous hinge and 3 tamper-resistant stainless steel Torx® with center pin fasteners.

**LENS:** See Lens Options below to specify lens material. Lens sealed to doorframe with silicone sealant and secured with continuous lens retention system. Lens orientation – smooth side out. Minimum .187" polycarbonate lens required (max. .375") for Peace of Mind Guarantee®.

**ELECTRICAL:** Available 3000K, 3500K, 4000K and 5000K color temperatures. 120-277VAC and 347VAC, 50/60Hz electrical input with serviceable high power factor electronic, constant-current driver (<20% THD, >0.95 PF). Standard 0-10V dimming with 1-100% range and dim-to-dark capabilities (non dim-to-dark with 347V); 660 µA maximum source current.

**SENSOR & CONTROLS:** Optional sensor available with compatible third party controls. To see the full list of compatible controls, [click here](#).

**INSTALLATION:** Adjustable swing-out mounting brackets standard.

**PHOTOMETRICS:** Photometry tested to the IESNA LM-79-08 standard. For additional photometric data, please go to [www.kenall.com](http://www.kenall.com)

**WARRANTY:** Limited five (5) year LED warranty. [Peace of Mind Guarantee against breakage](#).

**LISTINGS:** Luminaire is certified to UL standards by Intertek Testing Laboratory for non-IC and Wet Location installations. ETL certified IP65 per IEC60598. CCEA approved.



**ORDERING INFORMATION (Ex: HASEDI-24-67L-40K8-DIM1-DV-2F-2H-SYM/9)**

Model	Size	Lamp Power	Lamp Color	Driver	Voltage	Doorframe	Housing	Lens Type	Options
<b>HASEDI</b>									
<b>Size</b>									
14	1'x4'	<b>Lamp Power</b>		<b>Driver Type</b>		<b>Options</b>			
22	2'x2'	1x4L	45 Watt LED	DIM1	0-10V Dimming to 1%	LEL* 8-4W Emergency Battery Pack			
24	2'x4'	45L†	45 Watt LED	<b>Voltage</b>		20KV 20KV/KA Surge Protection per IEEE/ANSI C62.41.2 Cat. A			
		67L	67 Watt LED	DV	120-277VAC, 50/60Hz	FS Fuse & Holder			
		90L	90 Watt LED	120	120VAC	HJ Sealed Wireway			
		<b>2'x2'</b>		277	277VAC	IF† Install Frame			
		45LD	45 Watt Dual-Row LED	347	347VAC	PF* Plaster Frame			
		67L	67 Watt LED	<b>Doorframe Options</b>		RF* Radio Frequency Filter			
		90L	90 Watt LED	2F	18-Ga CRS in Gloss White (STD)	RM† Continuous Row Mounting			
		<b>2'x4'</b>		3F	20-Ga Type 304 SS with 48 Brushed Finish	TH 1/2" Trade Size Threaded Hub			
		45LD	45 Watt Dual-Row LED	<b>Housing/Flange Options</b>		2C Two Circuit Wiring			
		67L	67 Watt LED	2H	20-Ga CRS/18-Ga CRS in Gloss White (STD)	* Add .375" to ceiling cut out dimensions			
		90L	90 Watt LED	5H5	20-Ga Type 304 SS/18-Ga Type 304 SS with 48 Brushed Finish	† Only available when installed in drywall ceilings (flange mount)			
		135L	135 Watt LED	2H5	20-Ga CRS/18-Ga Type 304 SS with 48 Brushed Finish	• Voltage specific selection required			
		180L	180 Watt LED	<b>Lens Type</b>		‡ n/a with 2C Option			
		<b>Lamp Color</b>		6	.187" #12 Prismatic Polycarbonate	▲ n/a with 180L lamp option or 347V input; voltage-specific selection required and height of fixture is 5.875" when specified with 135L lamp option; 0°C/32°F min. operating environment.			
		30K8	3000K / 82 CRI min.	SYM/9		Symmetric, Diffused DR Acrylic inside lens			
		35K8	3500K / 82 CRI min.	SL		Specified Lens			
		40K8	4000K / 82 CRI min.						
		50K8	5000K / 82 CRI min.						



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For additional photometry, go to [www.kenall.com](http://www.kenall.com)

**HIGH ABUSE**  
**HASEDI SERIES – LED – INSET DOOR**

PERFORMANCE		Initial Delivered Lumens		Input Power (W)	Drive Current (mA)	Estd. L70 LED Life (Hrs)
Model	Lamp Type	@ 25°C	Efficacy (lm/W)			
HASEDI14	45L-30K8	4,480	97	46	100	80,000
	45L-35K8	4,633	100			
	45L-40K8	4,776	103			
	45L-50K8	4,967	108			
	67L-30K8	6,862	95	72	75	80,000
	67L-35K8	7,096	99			
	67L-40K8	7,316	102			
	67L-50K8	7,608	106			
	90L-30K8	8,818	90	98	100	60,000
	90L-35K8	9,119	93			
	90L-40K8	9,401	96			
	90L-50K8	9,777	100			
HASEDI22	45LD-30K8	4,633	100	47	100	80,000
	45LD-35K8	4,792	103			
	45LD-40K8	4,940	106			
	45LD-50K8	5,137	110			
	67L-30K8	7,098	99	72	75	80,000
	67L-35K8	7,340	102			
	67L-40K8	7,567	105			
	67L-50K8	7,869	109			
	90L-30K8	9,120	93	98	100	60,000
	90L-35K8	9,431	96			
	90L-40K8	9,723	99			
	90L-50K8	10,112	103			
HASEDI24	45LD-30K8	5,602	123	45	50	100,000
	45LD-35K8	5,793	128			
	45LD-40K8	5,972	132			
	45LD-50K8	6,211	137			
	67L-30K8	8,184	114	72	75	80,000
	67L-35K8	8,464	118			
	67L-40K8	8,725	121			
	67L-50K8	9,074	126			
	90L-30K8	10,517	112	94	100	60,000
	90L-35K8	10,876	116			
	90L-40K8	11,212	120			
	90L-50K8	11,660	125			
	135L-30K8	14,908	101	147	100	60,000
	135L-35K8	15,417	105			
	135L-40K8	15,894	108			
	135L-50K8	16,529	112			
	180L-30K8	20,328	104	196	100	60,000
	180L-35K8	21,022	107			
	180L-40K8	21,672	111			
	180L-50K8	22,539	115			

Provided information includes SYM9 Lens Type. Information subject to change without notice. Visit [www.kenall.com](http://www.kenall.com) for IES files and additional information.



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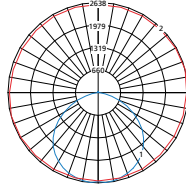
For additional photometry, go to [www.kenall.com](http://www.kenall.com)

**HIGH ABUSE**

**HASEDI SERIES – TECHNICAL DATA**

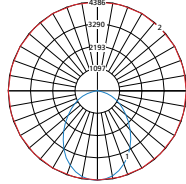
**PERFORMANCE**

Model: HASEDI-14-67L-40K8-DIM1-DV-2F-2H-SYM



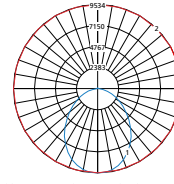
Maximum Candela = 2638 Located At Horizontal Angle = 15, Vertical Angle = 5  
 1 - Vertical Plane Through Horizontal Angles (15-195) (Through Max. Cd.)  
 2 - Horizontal Cone Through Vertical Angle (5) (Through Max. Cd.)

Model: HASEDI-22-90L-40K8-DIM1-DV-2F-2H-SYM



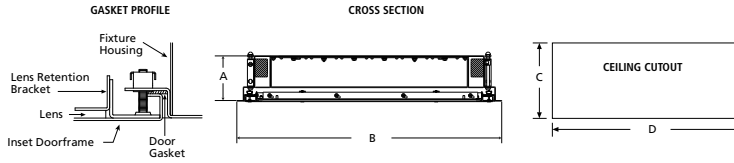
Max Candela = 4386 Located At Horizontal Angle = 0, Vertical Angle = 0  
 1 - Vertical Plane Through Horizontal Angles (0 - 180) (Through Max. Cd.)  
 2 - Horizontal Cone Through Vertical Angle (5) (Through Max. Cd.)

Model: HASEDI-24-180L-40K8-DIM1-DV-2F-2H-SYM



Max Candela = 9534 Located At Horizontal Angle = 0, Vertical Angle = 5  
 1 - Vertical Plane Through Horizontal Angles (0 - 180) (Through Max. Cd.)  
 2 - Horizontal Cone Through Vertical Angle (5) (Through Max. Cd.)

**DIMENSIONAL DATA**



**DIMENSIONAL DATA (IN INCHES)**

	A	B	C	D
1x4	4.20	11.75 x 47.75	10.85	46.85
2x2	4.20	23.75 x 23.75	22.85	22.85
2x4	4.20	23.75 x 47.75	22.85	46.85

\* Add .375" to ceiling cut out dimensions when IF Option is specified  
 \*\* Height is 5.875" with 135L lamp option when ordered in conjunction with LEL option.



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**MILLENNIUM DOWNLIGHT**  
 Luminares for High Abuse Applications  
**HADL SERIES**

**TYPE L4**  
 Other Manufacturers:  
 Paco Lighting MDA6 Series  
 Cooper Lighting Fail Safe Series FLD6BX  
 New Star Lighting DLM6 Series

- PRODUCT FEATURES:**
- » 6" sealed, recessed downlight with flush lens trim
  - » Peace of Mind Guarantee® against breakage
  - » Delivered lumens: 715 - 5,305 lm
  - » 1% Dimming via 0-10V or DALI control



**SPECIFICATIONS**

**HEAT SINK:** Die-cast aluminum with external radial fins for natural convection.

**ROUGH-IN FRAME:** 18-gauge die-formed, corrosion-resistant steel (type 304 stainless with NAT option). Vertically adjustable collar accommodates ceiling thicknesses up to 2", adjustable post-installation. Universal mounting brackets accept 3/4" and 1-1/2" fathers channel, 1/2" EMT conduit and hanger bars. Quick-access junction box accessible post-installation from above and below ceiling. Includes (4) 1/2" and (2) 3/4" knock-outs to allow straight conduit runs. Listed for (8) 12AWG, 90°C conductors and feed-thru branch wiring. Provided with FMC with electrical quick-connect to Trim Section.

**TRIM/HOUSING SECTION:** IP-rated housing section incorporates the heat sink, LED module, optics and lower trim. Flush lens trim secured with four (4) Torx® tamper-resistant, captive fasteners. See trim ordering information for available options.

**OPTICAL:** High-Efficiency mixing chamber design with recessed diffused tempered-glass lens producing uniform light output. Available with various reflector distribution patterns and finishes. Flush lens trim options include a clear lens. See distribution and reflector finish ordering information for available options.

**ELECTRICAL:** LED array available in multiple CCT and CRI combinations with a maximum 3-step MacAdam variation allowance. See Trim Ordering Information for available options. 120-277VAC or 347VAC, 50/60Hz electrical input with serviceable constant current driver (<20% THD, >0.90 PF). Minimum 85% driver efficiency. Standard 0-10V dimming with 1-100% range and dim-to-dark capabilities (non dim-to-dark with 347V); 165µA maximum source current. Optional eLoLED ECOdrive DALI driver with 1-100%.

**PHOTOMETRICS:** Photometry tested to the IESNA LM-79-08 standard by an ILAC/ISO17025 accredited laboratory. For photometric information, go to [www.kenall.com](http://www.kenall.com).

**WARRANTY:** Limited five (5) year LED warranty. [Peace of Mind Guarantee against breakage.](#)

**INSTALLATION:** Suitable for ambient temperature temperatures of -30°C to +40°C.

**LISTINGS:** Luminaire is certified to UL standards by Intertek Testing Laboratory for non-IC and Wet Location installations. IP65 rating per IEC60598. Optional CCEA compliance.



**ORDERING INFORMATION (EX: HADL6-FF-2FW-22L-40K8-W-CSS-G-RIG6-DV-DIM1)**

TRIM						ROUGH-IN					
Model	Trim Style	Trim Finish	Lamp Power	Lamp Color	Distribution	Reflector Finish	Flush Lens Type	Rough-In	Input Voltage	Driver Type	Options
<b>HADL6</b>	<b>FF</b>							<b>RIG6</b>			
<b>Trim Style</b>			<b>Lamp Color</b>			<b>Rough-In</b>					
FF Flush Lens (With Fasteners - IP65)			30K8 3000K / 80 CRI min.			RIG6 6" Rough-In					
			30K9 3000K / 90 CRI min.			Input Voltage					
			35K8 3500K / 80 CRI min.			DV 120-277V, 50/60Hz					
<b>Trim Finish</b>			35K9 3500K / 90 CRI min.			120 120VAC, 60Hz					
2FW Cold-Rolled Steel in Flat/White			40K8 4000K / 80 CRI min.			277 277VAC, 60Hz					
5BR Type 304 Stainless Steel with 48 Brushed Finish			40K9 4000K / 90 CRI min.			347* 347VAC, 60Hz					
XBR Type 316 Stainless Steel with 48 Brushed Finish			50K8 5000K / 80 CRI min.			<b>Driver Type</b>					
5FW Type 304 Stainless Steel in Flat White						DIM1 0-10V Dimming to 1%					
XFW Type 316 Stainless Steel in Flat White			<b>Distribution</b>			DALI DALI Dimming to 1%					
PAFW Aluminum in Flat White			M Medium								
<b>Lamp Power</b>			W Wide			<b>Options</b>					
12L 12 Watt LED			<b>Reflector Finish</b>			LEL Emergency Battery Backup with Remote Test Switch					
22L 22 Watt LED			FW Flat White			NAT Natatorium Environment					
33L 33 Watt LED			CS Clear Specular			FS Fuse & Holder					
55L▲ 55 Watt LED			CSS Clear Semi-Specular			CCEA CCEA Approved (specified voltage required; n/a 347V)					
			<b>Flush Lens Type</b>			9500 Torx® Screwdriver					
			G 1/8" Clear Polycarbonate								
			J 1/4" Clear Polycarbonate								

\* N/A with DALI Driver Type. N/A with LEL option  
 † Requires selection of XBR or XFW Trim Finish. Rough-In frame constructed of Type 304 stainless steel in lieu of corrosion-resistant steel  
 ▲ Must be installed with a minimum 24" on-center spacing, 12" from wall, and have 3" clearance above the Trim/Housing



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**MILLENIUM DOWNLIGHT**

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Luminaires for High Abuse Applications

**HADL SERIES  
 PERFORMANCE**

Distribution	Optic		Lamp Power	Initial Delivered Lumens, By Lamp Color						Efficacy (lm/W)	Input Power (W)	Estd. L70 LED Life (hrs)				
	Reflector Finish	Lens Type		30K8	30K9	35K8	35K9	40K8	40K9				50K8			
M	CS	G	12L	1,048	876	1,048	887	1,090	887	1,114	58-74	15	80,000			
			22L	1,716	1,435	1,716	1,452	1,785	1,452	1,823	60-76	24	85,000			
			33L	2,487	2,079	2,487	2,104	2,586	2,104	2,642	59-75	35	70,000			
			55L	4,436	3,709	4,436	3,754	4,613	3,754	4,713	60-76	62	75,000			
			12L	923	772	923	781	960	781	980	51-65	15	80,000			
			22L	1,511	1,263	1,511	1,279	1,571	1,279	1,605	53-67	24	85,000			
		33L	2,189	1,830	2,189	1,853	2,277	1,853	2,326	52-66	35	70,000				
		55L	3,905	3,265	3,905	3,305	4,061	3,305	4,149	53-67	62	75,000				
		G	12L	1,048	876	1,048	887	1,090	887	1,114	58-74	15	80,000			
			22L	1,716	1,435	1,716	1,452	1,785	1,452	1,823	60-76	24	85,000			
			33L	2,487	2,079	2,487	2,104	2,586	2,104	2,642	59-75	35	70,000			
			55L	4,436	3,709	4,436	3,754	4,613	3,754	4,713	60-76	62	75,000			
	12L		923	772	923	781	960	781	980	51-65	15	80,000				
	22L		1,511	1,263	1,511	1,279	1,571	1,279	1,605	53-67	24	85,000				
	CSS	G	12L	972	813	972	822	1,011	822	1,033	54-69	15	80,000			
			22L	1,591	1,331	1,591	1,347	1,655	1,347	1,691	55-70	24	85,000			
			33L	2,305	1,928	2,305	1,951	2,398	1,951	2,450	55-70	35	70,000			
			55L	4,113	3,439	4,113	3,481	4,277	3,481	4,370	55-70	62	75,000			
			12L	856	715	856	724	890	724	909	48-61	15	80,000			
			22L	1,401	1,171	1,401	1,186	1,457	1,186	1,488	49-62	24	85,000			
		9	33L	2,030	1,697	2,030	1,718	2,111	1,718	2,156	48-62	35	70,000			
			55L	3,621	3,028	3,621	3,064	3,766	3,064	3,847	49-62	62	75,000			
			FW	12L	1,180	986	1,180	998	1,227	998	1,253	67-86	15	80,000		
				22L	1,932	1,615	1,932	1,635	2,009	1,635	2,052	67-86	24	85,000		
33L				2,799	2,340	2,799	2,369	2,911	2,369	2,974	67-85	35	70,000			
55L				4,993	4,175	4,993	4,225	5,193	4,225	5,305	67-86	62	75,000			
12L	1,039	868		1,039	879	1,080	879	1,104	59-75	15	80,000					
22L	1,701	1,422		1,701	1,439	1,769	1,439	1,807	59-75	24	85,000					
W	CS	G	33L	2,464	2,060	2,464	2,085	2,562	2,085	2,618	59-75	35	70,000			
			55L	4,396	3,675	4,396	3,720	4,571	3,720	4,670	59-75	62	75,000			
			9	12L	1,001	837	1,001	847	1,041	847	1,064	57-73	15	80,000		
				22L	1,639	1,371	1,639	1,387	1,705	1,387	1,742	57-73	24	85,000		
				33L	2,375	1,986	2,375	2,010	2,470	2,010	2,524	57-72	35	70,000		
				55L	4,238	3,543	4,238	3,586	4,407	3,586	4,502	57-73	62	75,000		
		CSS		G	12L	881	737	881	746	917	746	937	50-64	15	80,000	
					22L	1,443	1,207	1,443	1,221	1,501	1,221	1,534	50-64	24	85,000	
			33L		2,091	1,748	2,091	1,770	2,175	1,770	2,222	50-63	35	70,000		
			9	55L	3,731	3,119	3,731	3,157	3,880	3,157	3,964	50-64	62	75,000		
				FW	G	12L	1,109	928	1,109	939	1,154	939	1,179	63-81	15	80,000
						22L	1,817	1,519	1,817	1,537	1,889	1,537	1,930	63-80	24	85,000
	33L	2,632	2,201			2,632	2,227	2,737	2,227	2,796	63-80	35	70,000			
	9	55L	4,695		3,926	4,695	3,974	4,883	3,974	4,989	63-80	62	75,000			
		G	12L		977	817	977	827	1,016	827	1,038	56-71	15	80,000		
			22L		1,599	1,337	1,599	1,353	1,663	1,353	1,699	56-71	24	85,000		
	33L		2,317	1,937	2,317	1,961	2,410	1,961	2,462	55-70	35	70,000				
	55L	4,134	3,456	4,134	3,498	4,299	3,498	4,392	56-71	62	75,000					

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**HADL SERIES**  
**PERFORMANCE**

Wide Distribution Candela Curve	HADL6-FF-12L-40K8-W-CS-G		Distance to illuminated plane (ft)	HADL6-FF-12L-40K8-M-CS-G		Medium Distribution Candela Curve
	Initial center beam foot-candles	Beam diameter (ft)		Initial center beam foot-candles	Beam diameter (ft)	
	28.4	7.6	5'	86.4	3.2	
	22.5	7.8	6'	60.0	3.5	
	16.5	9.2	7'	44.1	4.0	
	12.6	10.5	8'	33.7	4.6	
	10.0	11.8	9'	26.7	5.2	
	8.1	13.0	10'	21.6	5.8	
Spacing Criteria: 1.4	foot-candle multipliers for 30K8(.96), 30K9(.80), 35K8(.96), 35K9(.81), 40K9(.81), 50K8(1.0)					Spacing Criteria: 0.62
Beam Angle: 59°	Beam diameter is where foot-candles drop to 50% of maximum					Beam Angle: 34°

Wide Distribution Candela Curve	HADL6-FF-22L-40K8-W-CS-G		Distance to illuminated plane (ft)	HADL6-FF-22L-40K8-M-CS-G		Medium Distribution Candela Curve
	Initial center beam foot-candles	Beam diameter (ft)		Initial center beam foot-candles	Beam diameter (ft)	
	46.6	7.6	5'	141.4	3.2	
	36.8	7.8	6'	98.2	3.5	
	27.0	9.2	7'	72.2	4.0	
	20.7	10.5	8'	55.2	4.6	
	16.4	11.8	9'	43.7	5.2	
	13.3	13.0	10'	35.4	5.8	
Spacing Criteria: 1.4	foot-candle multipliers for 30K8(.96), 30K9(.80), 35K8(.96), 35K9(.81), 40K9(.81), 50K8(1.0)					Spacing Criteria: 0.62
Beam Angle: 59°	Beam diameter is where foot-candles drop to 50% of maximum					Beam Angle: 34°

Wide Distribution Candela Curve	HADL6-FF-33L-40K8-W-CS-G		Distance to illuminated plane (ft)	HADL6-FF-33L-40K8-M-CS-G		Medium Distribution Candela Curve
	Initial center beam foot-candles	Beam diameter (ft)		Initial center beam foot-candles	Beam diameter (ft)	
	67.5	7.6	5'	204.9	3.2	
	53.4	7.8	6'	142.3	3.5	
	39.1	9.2	7'	104.5	4.0	
	29.9	10.5	8'	80.0	4.6	
	23.8	11.8	9'	63.2	5.2	
	19.3	13.0	10'	51.2	5.8	
Spacing Criteria: 1.36	foot-candle multipliers for 30K8(.96), 30K9(.80), 35K8(.96), 35K9(.81), 40K9(.81), 50K8(1.0)					Spacing Criteria: 0.36
Beam Angle: 54°	Beam diameter is where foot-candles drop to 50% of maximum					Beam Angle: 21°

Wide Distribution Candela Curve	HADL6-FF-55L-40K8-W-CS-G		Distance to illuminated plane (ft)	HADL6-FF-55L-40K8-M-CS-G		Medium Distribution Candela Curve
	Initial center beam foot-candles	Beam diameter (ft)		Initial center beam foot-candles	Beam diameter (ft)	
	120.4	7.6	5'	365.5	3.2	
	95.2	7.8	6'	253.8	3.5	
	69.7	9.2	7'	186.5	4.0	
	53.4	10.5	8'	142.8	4.6	
	42.5	11.8	9'	112.8	5.2	
	34.4	13.0	10'	91.4	5.8	
Spacing Criteria: 1.36	foot-candle multipliers for 30K8(.96), 30K9(.80), 35K8(.96), 35K9(.81), 40K9(.81), 50K8(1.0)					Spacing Criteria: 0.36
Beam Angle: 54°	Beam diameter is where foot-candles drop to 50% of maximum					Beam Angle: 21°



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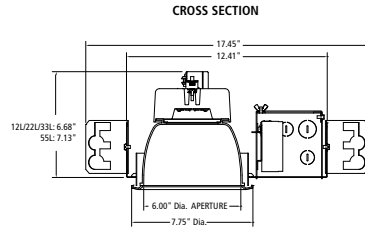
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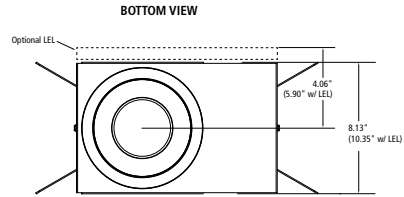
HADL6-012522

**MILLENIUM DOWNLIGHT**  
Luminaires for High Abuse Applications  
**HADL SERIES**

**DIMENSIONAL DATA**



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RECOMMENDED CEILING CUT-OUT: 7.38" Dia.



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**TYPE L5**  
 Other Manufacturers:  
 HE Williams 75L Series  
 Metalux SNX Lensed Series  
 Columbia Lighting Multipurpose Series

**FEATURES & SPECIFICATIONS**

**INTENDED USE** — The CLX is a linear lighting solution that is available in multiple lengths, lumen packages and distributions. Designed for versatility, the CLX can address virtually any indoor lighting need. The CLX is also offered in standard and high efficacy configurations and capable of being continuous row mounted or installed as a stand-alone fixture. Ideal for uplight and downlight in commercial, retail, manufacturing, warehouse, and display applications. **Certain airborne contaminants can diminish the integrity of acrylic and/or polycarbonate. Click here for Acrylic/Polycarbonate Compatibility table for suitable uses.**

**CONSTRUCTION** — Channel and cover are formed from code-gauge cold-rolled steel. Housing and lens endcaps are injection molded plastic to provide a more architectural look and feel. The endcaps come standard with a 7/8" knock out for continuous mounting but can be ordered without.

**Finish:** Paint options include high-gloss, baked white polyester (WH), galvanized (GALV), matte black (MB) and smoke gray (SGV). Five-stage iron phosphate pre-treatment ensures superior paint adhesion and rust resistance.

**OPTICS** — Offered with acrylic lens and less lens configurations. Provides a choice of optical distributions including, wide, narrow, and aisle.

Models with wide diffuse lens provide up to 12% uplight. Please check the IES file for specific uplight value.

**ELECTRICAL** — Utilizes high-output LEDs integrated on a two-layer circuit board, ensuring cool-running operation. Optional internal pluggable wiring harness for reduced labor cost in row mounting applications. (See PLR ordering information on page 14.) Electronic LED driver is multi-volt input and 0-10V dimming standard (see Operational Data on page 6 for actual wattage consumption). This fixture is designed to withstand a maximum line surge of 2.5kV at 0.75kA combination wave for indoor locations, for applications requiring higher level of protection additional surge protection must be provided.

L70->100,000 hours at 25°C.

LEDs provide nominal 80 CRI or 90 CRI at 3000 K, 3500 K, 4000 K, or 5000 K.

Lumen output up to 2,500 lumens per foot.

**INSTALLATION** — Fixture may be ceiling or wall mounted (with or without THCLX hanger or angle mounted with CLXANGBRT), pendant or stem mounted with appropriate mounting options.

**WARNING** — Removing the lens and opening the fixture during installation exposes the LEDs, putting them at risk for damage.

If you plan to surface mount the fixture, we recommend using the THCLX. This eliminates the need to open the fixture.

If you plan to continuous row mount, we recommend using the PLR wiring harness option. This eliminates the need to open the fixture.

Damage to the LEDs caused during installation will not be covered under the warranty.

**LISTINGS** — CSA certified to US and Canadian safety standards. For use in damp locations between -4°F (-20°C) and 104°F (40°C). Optional High Ambient (HA) ranging to 122°F(50°C) available on certain lumen packages (See ambient temperature chart for additional information). DesignLights Consortium® (DLC) Premium qualified product and DLC qualified product. Not all versions of this product may be DLC Premium qualified or DLC qualified. Please check the DLC Qualified Products List at [www.designlights.org/QPL](http://www.designlights.org/QPL) to confirm which versions are qualified.

**BUY AMERICAN** — Product with the BAA option is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT. Please refer to [www.acuitybrands.com/buy-american](http://www.acuitybrands.com/buy-american) for additional information.

**WARRANTY** — 5-year limited warranty. This is the only warranty provided and no other statements in this specification sheet create any warranty of any kind. All other express and implied warranties are disclaimed. Complete warranty terms located at: [www.acuitybrands.com/support/warranty/terms-and-conditions](http://www.acuitybrands.com/support/warranty/terms-and-conditions)

**Note:** Actual performance may differ as a result of end-user environment and application.

All values are design or typical values, measured under laboratory conditions at 25 °C.

Specifications subject to change without notice.

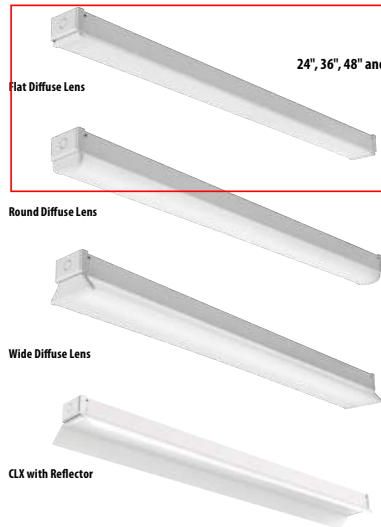
Stock configurations are offered for shorter lead times:

Stock Part Number	UPC
CLX L48 3000LM SEF FDL MVOLT G210 40K 80CRI WH	00191723525816
CLX L48 3000LM SEF FDL MVOLT G210 50K 80CRI WH	00191723525885
CLX L48 5000LM SEF FDL MVOLT G210 40K 80CRI WH	00191723525939
CLX L48 5000LM SEF FDL MVOLT G210 50K 80CRI WH	00191723525908
CLX L96 6000LM SEF FDL MVOLT G210 40K 80CRI WH	00191723525861
CLX L96 6000LM SEF FDL MVOLT G210 50K 80CRI WH	00191723525915
CLX L96 10000LM SEF FDL MVOLT G210 40K 80CRI WH	00191723525922
CLX L96 10000LM SEF FDL MVOLT G210 50K 80CRI WH	00191723525830
CLX L48 3000LM SEF RDL MVOLT G210 40K 80CRI WH	00191723525960
CLX L48 3000LM SEF RDL MVOLT G210 50K 80CRI WH	00191723525892
CLX L48 5000LM SEF RDL MVOLT G210 40K 80CRI WH	00191723525854
CLX L48 5000LM SEF RDL MVOLT G210 50K 80CRI WH	00191723525946
CLX L96 6000LM SEF RDL MVOLT G210 40K 80CRI WH	00191723525878
CLX L96 6000LM SEF RDL MVOLT G210 50K 80CRI WH	00191723525823
CLX L96 10000LM SEF RDL MVOLT G210 40K 80CRI WH	00191723525953
CLX L96 10000LM SEF RDL MVOLT G210 50K 80CRI WH	00191723525847

LED Linear

**CLX**

24", 36", 48" and 96" Lengths



**A+ Capable Luminaire**

This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and out-of-the-box control compatibility with simple commissioning.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is part of an A+ Certified solution for nLight® control networks marked by a shaded background\*

To learn more about A+, visit [www.acuitybrands.com/aplus](http://www.acuitybrands.com/aplus).

\*See ordering tree for details

### CLX LED Linear

ORDERING INFORMATION		Lead times will vary depending on options selected. Consult with your sales representative.			Example: CLX L48 5000LM SEF WDL MVOLT GZ10 40K 80CRI WH			
Series	Length	Nominal lumens		Performance package	Louwer	Lens		
CLX LED linear	L24 24"	1500LM	1,500 lumens	SEF Standard efficiency ‡	(Blank) Less louwer	L/Lens	Less lens	
		2000LM	2,000 lumens	HEF Premium efficiency ‡	SBLW Straight blade louwer, white ‡	FDL	Flat diffuse ‡	
		2500LM	2,500 lumens		SBLMB Straight blade louwer, matte black ‡	RDL	Round diffuse ‡	
		3500LM	3,500 lumens		SBLGV Straight blade louwer, galvanized ‡	WDL	Wide diffuse ‡	
		4500LM	4,500 lumens		SBLSGY Straight blade louwer, smoke gray ‡			
	L36 36"	2250LM	2,250 lumens					
		3000LM	3,000 lumens					
		3750LM	3,750 lumens					
		5250LM	5,250 lumens					
		6750LM	6,750 lumens					
	L48 48"	3000LM	3,000 lumens					
		4000LM	4,000 lumens					
		5000LM	5,000 lumens					
		7000LM	7,000 lumens ‡					
		9000LM	9,000 lumens ‡					
L96 96"	10000LM	10,000 lumens ‡						
	6000LM	6,000 lumens						
	8000LM	8,000 lumens						
	10000LM	10,000 lumens						
	14000LM	14,000 lumens ‡						
	18000LM	18,000 lumens ‡						
	20000LM	20,000 lumens ‡						
Distribution		Voltage		Driver ‡	Glare Reflector	Color temperature		Coloring rendering index
(Blank) General	MVOLT 120-277V ‡	277	277V	GZ1 Generic 0-10V, dims to 1% ‡	(blank) No reflectors	30K 3000 K	80CRI 80 CRI	
ND Narrow ‡	120 120V	347	347V ‡	GZ10 Generic 0-10V, dims to 10% ‡	LUGR Reflectors for additional glare reduction ‡	35K 3500 K	90CRI 90 CRI	
WD Wide ‡	208 208V ‡	480	480V ‡	EZ1 eldoLED 0-10V, dims to 1% ‡		40K 4000 K		
AD2 Aisle, 24" off center ‡	240 240V ‡					50K 5000 K		
Options							Finish	
PS1050	Emergency battery pack, 10W, CA Title 20 Noncompliant ‡	PLR___	Plug-in wiring, see page 14 for ordering information	nLight™ Wired: ‡			WH White	
E10WLCP	Emergency battery pack, 10W Linear Constant Power, Certified in CA Title 20 MAEDBS ‡	PLR1LVG	Plug-in wiring, low voltage dimming ‡	N100 nLight™ without lumen management			GALVW Galvanized with white lens end caps	
BGTD	Generator transfer device, not available with PS1050 ‡	RRL___	RELOC™-ready luminaire. See page 14 for ordering information	N100EMG nLight™ without lumen management. For use with generator supply EM power ‡			GALVB Galvanized with black lens end caps	
OCS	5', 18/3 Reloc selectable One Pass cable (fixture will bear dry location label) ‡	SPD	Surge protection device, provides up to 6kV protection ‡	NES7 nLight™ nES7 PIR integral occupancy sensor ‡			MB Matte black	
HA	High ambient, for use in ambient temperatures up to 50°C ‡	BAA	Buy America(n) Act Compliant	NESPDT7 nLight™ nES7 PDT 7 dual technology integral occupancy control ‡			SKGYW Smoke gray with white lens end caps	
EPNKO	Decorative endplate, no knock out ‡	nLight™ Wireless: ‡		NES7ADCX nLight™ nES7 ADCX PIR integral occupancy sensor with automatic dimming photocell ‡			SKGYB Smoke gray with black lens end caps	
OUTCTR	Wiring leads pulled through back center of fixture ‡	NLTAIR2 RES7	nLight™ Generation 2 enabled PIR integral occupancy sensor with automatic dimming photocell	NESPDT7ADCX nLight™ nES7 PDT 7 dual technology integral occupancy sensor with automatic dimming photocell ‡				
OUTEND	Wiring leads pulled through end of fixture ‡	NLTAIR2 RES7PDT	nLight™ AIR Generation 2 enabled dual technology integral occupancy sensor with automatic dimming photocell	Individual controls: ‡				
Cord Sets:		NLTAIR2 RIO	No sensor control	MSD7 PIR integral occupancy sensor				
CS1W	6' Straight blade plug, 120V ‡			MSDPDT7 PDT 7 dual technology integral occupancy control				
CS3W	NEMA twist-lock plug, 120V ‡			MSD7ADC PIR integral occupancy sensor with automatic dimming control photocell				
CS7W	Straight blade plug, 277V ‡			MSDPDT7ADC PDT integral occupancy sensor with automatic dimming control photocell				
CS11W	NEMA twist-lock plug, 277V ‡							
CS25W	NEMA twist-lock plug, 347V ‡							
CS97W	NEMA twist-lock plug, 480V ‡							
CS93W	600V SEOOW white cord, no plug (no voltage required)							
CS6W16STOWSD	6' white cord, 16/5, no plug, includes low voltage dimming wires (no voltage required) ‡							

See Accessories and footnotes on next page

CLX



**CLX LED Linear**

Accessories: Order as separate catalog number.		
<b>Mounting:</b>		THCLX ___ Tong hanger (Must specify color) ‡
ZACVH M100	Adjustable 10' aircraft cable with Y hanger (1 pair)	CLXANGBKT ___ Angle bracket, (Must specify color) (one pair) ‡
ZAC120	One adjustable aircraft cable with canopy 120" ‡	HC36 M12 ___ Hanger chain, 36" (1 pair)
ZACFP120	One adjustable aircraft cable with feed (3 conductor) and canopy, 120" ‡	<b>Reflectors:</b>
ZACFPD120	One adjustable aircraft cable with feed (5 conductor) and canopy 120" ‡	CLXRW24 ___ Wide decorative 24" reflector, (Must specify color) ‡
ZAC240	One adjustable aircraft cable with canopy 240" ‡	CLXRW36 ___ Wide decorative 36" reflector, (Must specify color) ‡
ZACFP240	One adjustable aircraft cable with feed (3 conductor) and canopy, 240" ‡	CLXRW48 ___ Wide decorative 48" reflector, (Must specify color) ‡
ZACFPD240	One adjustable aircraft cable with feed (5 conductor) and canopy 240" ‡	CLXRW96 ___ Two wide decorative 48" reflectors, (Must specify color) ‡
SQ ___	Swivel stem hanger (specify length in 2" increments up to 48") ‡	CLXRWU24 ___ Wide decorative 24" reflector with uplight, (Must specify color) ‡
		CLXRWU36 ___ Wide decorative 36" reflector with uplight, (Must specify color) ‡
		CLXRWU48 ___ Wide decorative 48" reflector with uplight, (Must specify color) ‡
		CLXRWU96 ___ Two wide decorative 48" reflectors with uplight, (Must specify color) ‡
		<b>Wireguards:</b>
		CLXRN24 ___ Narrow 24" reflector, (Must specify color) ‡
		CLXRN36 ___ Narrow 36" reflector, (Must specify color) ‡
		CLXRN48 ___ Narrow 48" reflector, (Must specify color) ‡
		CLXRN96 ___ Two narrow 48" reflectors, (Must specify color) ‡
		WGCLX24 ___ 24" wireguard, (Must specify color) ‡
		WGCLX36 ___ 36" wireguard, (Must specify color) ‡
		WGCLX48 ___ 48" wireguard, XX, (Must specify color) 96" fixture requires two ‡

‡ Option Value Ordering Restrictions	
Option value	Restriction
347V, 480V	Voltage selected utilizes a step-down transformer. Not available with L24 when ordered with N100. Not available with PS1050, E10WLCP or BGTD option.
BGTD	Not available with MVOLT, 208V or 240V. Not available with HA. Available with L48 or L96 only. 20 Not available with PS1050 or E10WLCP options. Not available with 208 or 240V. Not available Individual controls, nLight Wired, or nLight Wireless options.
CLXRN REFLECTORS	For use with L/LENS fixtures only. L24 reflector is 22.75", L36 reflector is 34.20", L48 reflector is 46.85", L96 comes with two L48 reflectors.
CLXRW REFLECTORS	L24 reflector is 22.65", L36 reflector is 34.01", L48 reflector is 46.80", L96 comes with two L48 reflectors.
CS1W, CS3W, CS7W, CS11W, CS25W, CS97W	Not available with BGTD option. Must specify voltage.
CS6WG16STOWSD	Not available with Individual controls, nLight wired networking, nLight wireless networking, nLight wireless zone control options.
DRIVER	When continuous row mounting, fixtures must all have the same driver selection.
E10WLCP	Not available with OUTCR, Not available with HA. Not available with MVOLT, Must specify voltage. Not available with BGTD option. Requires SPD option. Not available with L24 or L36. Not available with L48 in combination with N100.
EPINKO	Not available OUTEND.
EZ1	Not available with HA option.
FDL, RDL, WDL	Only available with general distribution. Not available with CLXRN accessories.
GZ1, GZ10	Not available with Individual controls, nLight wired networking, nLight wireless networking, nLight wireless zone control options.
HA	Not available with L24, L26, Not available with BGTD option. Not available with EZ1. Only available with L48 3000/4000/5000LM and L96 6000/8000/10000LM.
HEF	not available with L48 3000LM and L96 6000LM
LUGR	Not available with L36 length. Only available with WH finish. Not compatible with THCLX Hanger or wireguard accessories. LUGR option required for some DLC premium qualifications - Please check the DLC Qualified Products List to determine if LUGR option is necessary to meet requirement. If mounting in continuous rows, ensure all models ordered with LUGR option if required on any configuration to ensure rows match in form factor. LUGR reflectors ship in standard fixture carton and are not sold as separate accessory - this option MUST be specified as part of the CLX model number.
MSD7, MSDPD7, MSD7ADC, MSDPD7ADC	Not available with any other control option. Requires EZ1. Sensor housing will be the same color as lens end caps.
N100, N100EMG	nLight EMG option requires a connection to existing nLight network. Power is provided from separate N100 enabled fixture.
ND, WD, AD2	Not available with CLXRN accessories. Available L/LENS only.
NES7, NESPDT7, NES7ADC, NESPDT7ADC	Not available with any other control option. Requires EZ1. Requires N100 or N100EMG option, N100EMG with NES7 requires RFA. Sensor housing will be the same color as lens end caps.
NLTAIR2 RES7, NLTAIR2 RES7PDT, NLTAIR2 RIO	Not available with 5000LM, 7500LM, 10000LM, 14000LM, 18000LM, 20000LM. Sensor housing will be the same color as lens end caps.
OCS	Must specify voltage.
OUTCR	Not available with L24, Not available with PLR options.
OUTEND	Not available with PLR options.
PLR1LVG	Not available with Individual controls, nLight Wired, or nLight Wireless options. Refer to page 14 for more PLR details.
PS1050	Not available with MVOLT, Must specify voltage. Not available with BGTD option. Requires SPD option. Not available with L24 or L36. Not available with L48 in combination with N100.
SBLW, SBLMB, SBLGV, SBLSKGY	When ordered with L24 only available with 1500LM or 2000LM in combination with GZ10 driver. Not for use with THCLX, CLXANGBKT, CLX reflectors or WGCLX accessories. Not available with RDL lens options.
SEF	Not available with EZ1 when ordered with L24 with 5000LM or L36 with 7500LM.
SPD	Required with PS1050, E10WLCP, BGTD, XAD, or XAD924.
THCLX ___ CLXANGBKT ___	Not available with lower, wireguards, wide reflectors. THCLX ___ not available with LUGR.
WIREGUARDS	Not for use with LUGR option or CLX wide reflector accessories.
ZAC120, ZACFP120, ZACFPD120, ZAC240, ZACFP240, ZAPFPD240, SQ	Ships standard as white



CLX

## CLX LED Linear

### OPTIONS AND ACCESSORIES



**Narrow reflector**  
 Ships separately from fixture.  
 Order as:  
 CLXRN24 \_\_\_\_\_  
 CLXRN36 \_\_\_\_\_  
 CLXRN48 \_\_\_\_\_  
 CLXRN96 \_\_\_\_\_



**Wide decorative reflector**  
 Ships separately from fixture.  
 Order as:  
 CLXRW24 \_\_\_\_\_  
 CLXRW36 \_\_\_\_\_  
 CLXRW48 \_\_\_\_\_  
 CLXRW96 \_\_\_\_\_



**Wireguard**  
 Ships separately from fixture:  
 96" fixture requires two WGCLX48.  
 Order as:  
 WGCLX24 \_\_\_\_\_  
 WGCLX36 \_\_\_\_\_  
 WGCLX48 \_\_\_\_\_



**LUGR glare reflector**  
 NOT available as accessory - must be specified  
 as part of the fixture nomenclature. See  
 ordering notes on page 3.



**Aircraft Cable with Canopy**  
 Available in 120" or 240"  
 Order as:  
 ZAC120 \_\_\_\_\_  
 ZAC240 \_\_\_\_\_



**HANGER CHAIN**  
 36" chain with Y hanger. ships as a pair  
 Order as:  
 HC36 \_\_\_\_\_



**ZACVH HANGER**  
 10' Aircraft cable with Y hanger.  
 Order as:  
 ZACVH \_\_\_\_\_



**Tong hanger**  
 Ships as a pair  
 Order As:  
 THCLX \_\_\_\_\_



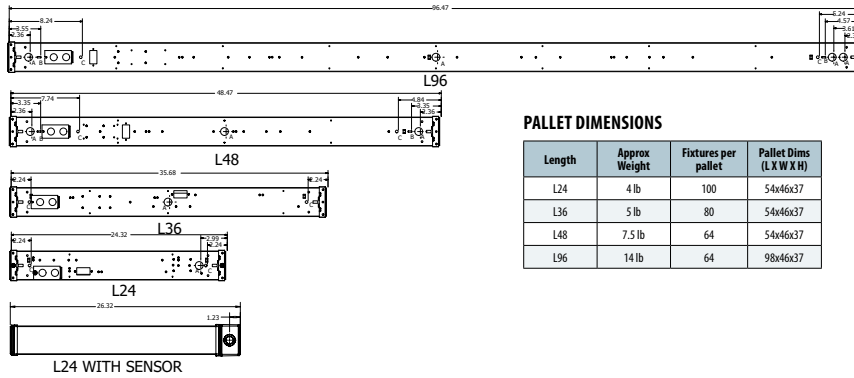
## CLX LED Linear

### DIMENSIONS

All dimensions are in inches (centimeters) unless otherwise indicated.  
 Dimensions may vary with options or accessories.

INTEGRATED SENSOR ADDS 2.0 INCHES TO STANDALONE FIXTURE LENGTH  
 HOUSING END CAP ADDS 0.236 INCHES TO FIXTURE LENGTH PER SIDE. DIMENSIONS BELOW INCLUDE ENDCAPS.

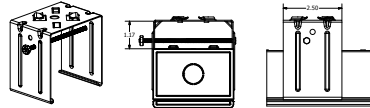
A - 7/8" KNOCK OUT  
 B - 0.5" by 0.16" SLOT  
 C - 0.3" DIA HOLE



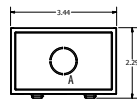
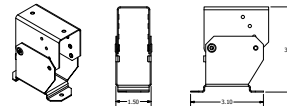
### PALLET DIMENSIONS

Length	Approx Weight	Fixtures per pallet	Pallet Dims (L X W X H)
L24	4 lb	100	54x46x37
L36	5 lb	80	54x46x37
L48	7.5 lb	64	54x46x37
L96	14 lb	64	98x46x37

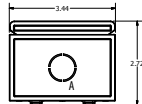
THCLX - SHIPS TWO PER ORDER.  
 UTILIZES A #10 HEX HEAD SCREW AND NUT.  
 FIXTURE SITS 1.3 INCHES FROM STRUCTURE WHEN MOUNTED



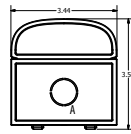
CLXANGBKT - SHIPS TWO PER ORDER.  
 HOLES TO MOUNTING STRUCTURE ARE 0.175" DIA, 2.5" APART.  
 FIXTURE SITS APPROXIMATELY 3.5" FROM STRUCTURE  
 WHEN MOUNTED HORIZONTAL TO STRUCTURE



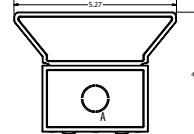
L/LENS



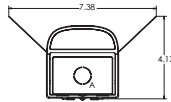
FDL



RDL



WDL



LUGR Reflector Option  
 - applies to all lens types

### PHOTOMETRICS

See [www.lithonia.com](http://www.lithonia.com).



COMMERCIAL INDOOR: One Lithonia Way, Conyers, GA 30012 Phone: 800-705-SEVY (7378) techsupport-commercialindoor@acuitybrands.com www.lithonia.com

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## CLX LED Linear

### POWER SENTRY EMERGENCY BATTERY PACKS

		SEF Emergency Lumens	HEF Emergency Lumens
PS1050	Factory installable	1400	1500
E10WLCP	Factory installable	1400	1500
PS1555LCP	Field installable, remote mount only	2000	2100

Note: For emergency lumen output of specific model, please consult factory. One board will be illuminated during emergency operation.

### CLX CHARACTERISTICS

Nominal Lumen Package	Length	Wattage								Length	Width	Depth	Comparable Light Source
		Standard Efficiency				High Efficiency							
		120V	277V	347V	480V	120V	277V	347V	480V				
2500LM	24"	18.4	18.4	24.0	24.0	17.4	17.4	23.1	23.1	24	3.5	3.75	1-lamp 32W T8, 1-lamp 54W TSHO, 50W HID
5000LM	24"	41.5	41.5	47.4	47.4	38.1	38.1	44.1	44.1	24	3.5	3.75	2-lamp 32W T8, 1-lamp 54W TSHO, 70W HID
3750LM	36"	26.5	26.5	32.1	32.1	25.1	25.1	30.7	30.7	36	3.5	3.75	1-lamp 32W T8, 1-lamp 54W TSHO, 50W HID
7500LM	36"	62.6	62.6	68.6	68.6	54.0	54.0	59.7	59.7	36	3.5	3.75	2-lamp 32W T8, 1-lamp 54W TSHO, 70W HID
5000LM	48"	31.8	31.8	37.2	37.2	31.8	31.8	37.6	37.6	48	3.5	3.75	2-lamp 32W T8, 1-lamp 54W TSHO, 70W HID
10000LM	48"	70.7	70.7	76.2	76.2	65.3	65.3	70.8	70.8	48	3.5	3.75	3-lamp 32W T8, 2-lamp 54W TSHO, 100W HID
10000LM	96"	63.7	63.7	69.0	69.0	63.7	63.7	69.5	69.5	96	3.5	3.75	3-lamp 32W T8, 2-lamp 54W TSHO, 100W HID
20000LM	96"	141.3	141.3	146.8	146.8	130.5	130.5	136.1	136.1	96	3.5	3.75	6-lamp 32W T8, 4-lamp 54W TSHO, 200W HID



CLX

COMMERCIAL INDOOR: One Lithonia Way, Conyers, GA 30012 Phone: 800-705-SERV (7378) techsupport-commercialindoor@acuitybrands.com www.lithonia.com

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## CLX LED Linear

### RRL - RELOC®-Ready Luminaire

- RRL connectors can be used with Quick-Flex®, System 820 and OnePass® systems.
- Load side of connector factory installed to luminaire.
- 4-pole mating connector with push-in terminations allows for simple installation.
- Touch-safe design on both halves meets UL/CSA requirement.
- Wiping contact design allows safe disconnect under load.



#### ORDERING INFORMATION

Lead times will vary depending on options selected. Consult with your sales representative.

Example: RRLA

Series	Wiring instructions
RRL RELOC®-ready luminaire	A Hot conductor wired to position #1 (phase A) B Hot conductor wired to position #2 (phase B) C Hot conductor wired to position #3 (phase C) <sup>1</sup>

### Compatible RELOC® Cables for Industrial Luminaires (ordered and shipped separately)



#### Notes

<sup>1</sup> C, ABE, and C125 options are not used with Quick-Flex QFC, QSC, QPT, and QD.

### PLUG-IN WIRING INFORMATION

Advanced plug-in system with two-circuit capability. Available on industrial and strip products and a variety of architectural products mounted in continuous rows. PLR22 (2-circuit) and crossover harness switches hot circuit serving next fixture in row. Reduces fixture types on job for alternating circuit applications (see example below.)

Easy one-step installation, saves up to 35% on labor costs. Expanded switching flexibility helps save energy.

Rows can be 50% longer with two-circuit systems. Polarized, lock-together nylon connectors prevent miswiring in the field. #12 THHN conductor, rated 600V, 90°C. White neutral wire included. Grounding accomplished by fixture in-row connectors.

CSA certified systems available with up to 2 circuits. G ground required.

Not for use with dedicated emergency circuits.

Note: Specifications subject to change without notice.



Wiring

## PLR

Advanced 1 or 2-Circuit Plug-In

#### ORDERING INFORMATION

Lead times will vary depending on options selected. Consult with your sales representative.

Series	Number of hot wires	Branch circuits	Dimming	Ground
PLR	(blank) Not required for PLR22	Circuits to which driver is connected	LV Low-voltage dimming	G Ground (required)
PLR22	1 Black 2 Black and red	(blank) Not required for PLR22 A Black wire B Red wire		
		Battery charging circuit (must be unswitched) (blank) No battery charging circuit ELA Battery pack wired to black wire ELB Battery pack wired to red wire		

#### Typical Applications

- Multiple-circuit and single-circuit for longer continuous rows
- Multiple-circuit with alternating fixtures on separate circuits and 2-circuit PLR22
- Multiple circuit with night-lights located along row as desired



CLX

**TYPE L6**  
 Other Manufacturers:  
 Paco Lighting MRGA2 Series  
 Cooper Lighting Fail-Safe FMR Series  
 New Star Lighting 57R Series

**HIGH ABUSE**  
**HASEDI SERIES – LED – INSET DOOR**

**PRODUCT FEATURES:**

- » High-output lamp sources for accurate color rendition and lighting performance
- » Diffused high-efficiency lens for reduced glare
- » Recessed ceiling mount; grid or flange 1'x4', 2'x2', 2'x4'
- » Suitable for universal installation into 1.0" and 1.5" grid or flange (drywall) ceilings
- » One-piece inset doorframe, secured to housing with continuous piano hinge and Torx® fasteners
- » Peace of Mind Guarantee® against breakage



**SPECIFICATIONS**

**HOUSING:** 20-gauge CRS. Hole-free, one-piece, seam-welded construction. Integral aluminum heat sink for thermal dissipation. 18-gauge housing flange with mitered and welded corners. White TGIC polyester powder coat finish – 5-step pre-treatment. Salt spray test: 1,000 hours; Reflectance: 92%.

**DOORFRAME:** 18-gauge CRS. One-piece inset construction welded corners. White TGIC polyester powder coat – 5-stage pre-treatment. Salt spray test: 1,000 hours; Reflectance: 92%. Lens frame secured to housing with continuous hinge and 3 tamper-resistant stainless steel Torx® with center pin fasteners.

**LENS:** See Lens Options below to specify lens material. Lens sealed to doorframe with silicone sealant and secured with continuous lens retention system. Lens orientation – smooth side out. Minimum .187" polycarbonate lens required (max. .375") for Peace of Mind Guarantee®.

**ELECTRICAL:** Available 3000K, 3500K, 4000K and 5000K color temperatures. 120-277VAC and 347VAC, 50/60Hz electrical input with serviceable high power factor electronic, constant-current driver (<20% THD, >0.95 PF). Standard 0-10V dimming with 1-100% range and dim-to-dark capabilities (non dim-to-dark with 347V); 660 µA maximum source current.

**SENSOR & CONTROLS:** Optional sensor available with compatible third party controls. To see the full list of compatible controls, [click here](#).

**INSTALLATION:** Adjustable swing-out mounting brackets standard.

**PHOTOMETRICS:** Photometry tested to the IESNA LM-79-08 standard. For additional photometric data, please go to [www.kenall.com](#)

**WARRANTY:** Limited five (5) year LED warranty. [Peace of Mind Guarantee against breakage](#).

**LISTINGS:** Luminaire is certified to UL standards by Intertek Testing Laboratory for non-IC and Wet Location installations. ETL certified IP65 per IEC60598. CCEA approved.



**ORDERING INFORMATION (Ex: HASEDI-24-67L-40K8-DIM1-DV-2F-2H-SYM/9)**

Model	Size	Lamp Power	Lamp Color	Driver	Voltage	Doorframe	Housing	Lens Type	Options
<b>HASEDI</b>									
<b>Size</b>									
14	1'x4'								
22	2'x2'								
24	2'x4'								
<b>Lamp Power</b>									
	1'x4'								
	2'x2'								
	2'x4'								
<b>Lamp Color</b>									
<b>Driver Type</b>									
<b>DIM1</b> 0-10V Dimming to 1%									
<b>Voltage</b>									
<b>DV</b> 120-277VAC, 50/60Hz									
<b>120</b> 120VAC									
<b>277</b> 277VAC									
<b>347</b> 347VAC									
<b>Doorframe Options</b>									
<b>2F</b> 18-Ga CRS in Gloss White (STD)									
<b>3F</b> 20-Ga Type 304 SS with #8 brushed Finish									
<b>Housing/Flange Options</b>									
<b>2H</b> 20-Ga CRS/18-Ga CRS in Gloss White (STD)									
<b>5H5</b> 20-Ga Type 304 SS/18-Ga Type 304 SS with 48 Brushed Finish									
<b>2H5</b> 20-Ga CRS/18-Ga Type 304 SS with 48 Brushed Finish									
<b>Lens Type</b>									
<b>G</b> .187" #12 Prismatic Polycarbonate									
<b>SYM/9</b> Symmetric, Diffused DR Acrylic inside lens .250" Clear Polycarbonate outside lens									
<b>SL</b> Specified Lens									
<b>Options</b>									
<b>LEL*</b> 8-4W Emergency Battery Pack									
<b>20KV</b> 20KV/KA Surge Protection per IEEE/ANSI C62.41.2 Cat. A Fuse & Holder									
<b>FS</b> Sealed Wireway									
<b>HJ</b> Install Frame									
<b>IF*</b> Plaster Frame									
<b>PF*</b> Radio Frequency Filter									
<b>RF*</b> Continuous Row Mounting									
<b>RM†</b> 1/2" Trade Size Threaded Hub									
<b>TH</b> Two Circuit Wiring									
<b>2C</b>									
* Add .375" to ceiling cut out dimensions									
† Only available when installed in drywall ceilings (flange mount)									
• Voltage specific selection required									
‡ n/a with 2C Option									
▲ n/a with 180L lamp option or 347V input; voltage-specific selection required and height of fixture is 5.875" when specified with 135L lamp option; 0°C/32°F min. operating environment.									



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 This product complies with the Buy American Act; manufactured in the United States with more than 50% of the component cost of US origin. It may be covered by patents found at [www.kenall.com/patents](#). Content of specification sheets is subject to change; please consult [www.kenall.com](#) for current product details. ©2022 Kenall Mfg Co.

A brand of **Legrand**  
 HASEDI\_14\_22\_24-072121

For additional photometry, go to [www.kenall.com](http://www.kenall.com)

**HIGH ABUSE**  
**HASEDI SERIES – LED – INSET DOOR**

PERFORMANCE		Initial Delivered Lumens		Input Power (W)	Drive Current (mA)	Estd. L70 LED Life (Hrs)
Model	Lamp Type	@ 25°C	Efficacy (lm/W)			
HASEDI14	45L-30K8	4,480	97	46	100	80,000
	45L-35K8	4,633	100			
	45L-40K8	4,776	103			
	45L-50K8	4,967	108			
	67L-30K8	6,862	95	72	75	80,000
	67L-35K8	7,096	99			
	67L-40K8	7,316	102			
	67L-50K8	7,608	106			
	90L-30K8	8,818	90	98	100	60,000
	90L-35K8	9,119	93			
	90L-40K8	9,401	96			
	90L-50K8	9,777	100			
HASEDI22	45LD-30K8	4,633	100	47	100	80,000
	45LD-35K8	4,792	103			
	45LD-40K8	4,940	106			
	45LD-50K8	5,137	110			
	67L-30K8	7,098	99	72	75	80,000
	67L-35K8	7,340	102			
	67L-40K8	7,567	105			
	67L-50K8	7,869	109			
	90L-30K8	9,120	93	98	100	60,000
	90L-35K8	9,431	96			
	90L-40K8	9,723	99			
	90L-50K8	10,112	103			
HASEDI24	45LD-30K8	5,602	123	45	50	100,000
	45LD-35K8	5,793	128			
	45LD-40K8	5,972	132			
	45LD-50K8	6,211	137			
	67L-30K8	8,184	114	72	75	80,000
	67L-35K8	8,464	118			
	67L-40K8	8,725	121			
	67L-50K8	9,074	126			
	90L-30K8	10,517	112	94	100	60,000
	90L-35K8	10,876	116			
	90L-40K8	11,212	120			
	90L-50K8	11,660	125			
	135L-30K8	14,908	101	147	100	60,000
	135L-35K8	15,417	105			
	135L-40K8	15,894	108			
	135L-50K8	16,529	112			
	180L-30K8	20,328	104	196	100	60,000
	180L-35K8	21,022	107			
	180L-40K8	21,672	111			
	180L-50K8	22,539	115			

Provided information includes SYM9 Lens Type. Information subject to change without notice. Visit [www.kenall.com](http://www.kenall.com) for IES files and additional information.



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HASEDI\_14\_22\_24-072121

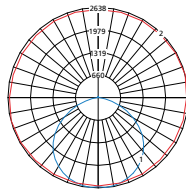
For additional photometry, go to [www.kenall.com](http://www.kenall.com)

**HIGH ABUSE**

**HASEDI SERIES – TECHNICAL DATA**

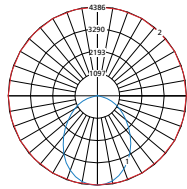
**PERFORMANCE**

Model: HASEDI-14-67L-40K8-DIM1-DV-2F-2H-SYM



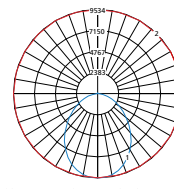
Maximum Candela = 2638 Located At Horizontal Angle = 15, Vertical Angle = 5  
 1 - Vertical Plane Through Horizontal Angles (15-195) (Through Max. Cd.)  
 2 - Horizontal Cone Through Vertical Angle (5) (Through Max. Cd.)

Model: HASEDI-22-90L-40K8-DIM1-DV-2F-2H-SYM



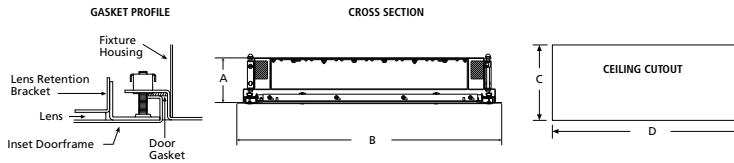
Max Candela = 4386 Located At Horizontal Angle = 0, Vertical Angle = 0  
 1 - Vertical Plane Through Horizontal Angles (0 - 180) (Through Max. Cd.)  
 2 - Horizontal Cone Through Vertical Angle (0) (Through Max. Cd.)

Model: HASEDI-24-180L-40K8-DIM1-DV-2F-2H-SYM



Max Candela = 9534 Located At Horizontal Angle = 0, Vertical Angle = 5  
 1 - Vertical Plane Through Horizontal Angles (0 - 180) (Through Max. Cd.)  
 2 - Horizontal Cone Through Vertical Angle (5) (Through Max. Cd.)

**DIMENSIONAL DATA**



**DIMENSIONAL DATA (IN INCHES)**

	A	B	C	D
1x4	4.20	11.75 x 47.75	10.85	46.85
2x2	4.20	23.75 x 23.75	22.85	22.85
2x4	4.20	23.75 x 47.75	22.85	46.85

\* Add .375" to ceiling cut out dimensions when IF Option is specified  
 \*\* Height is 5.875" with 135L lamp option when ordered in conjunction with LEL option.



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HASEDI\_14\_22\_24-072121

**MIGHTY MAC™**  
**SCA SERIES**

**PRODUCT FEATURES:**

- » Surface ceiling mount – 12" x 24" **12" x 48"**
- » TIG welded housing with no post grinding for additional strength
- » Vertically adjustable Z bracket with thru-studs spaced 6" apart
- » Full length concealed internal piano hinge



**TYPE L7**  
 Other Manufacturers:  
 Paco Lighting PUSA Series  
 Cooper Lighting Fail-Safe FMS Series  
 New Star Lighting Confinement UMW4 Series

**SPECIFICATIONS**

**HOUSING:** One-piece die-formed prime grade material as specified – see Ordering Information. Corners continuously seam welded and smooth with no post grinding (TIG). Clamshell housing resistant to penetration and contraband concealment.

**BASEPLATE:** Prime grade material as specified – see Ordering Information. Die-formed blade trap (1/4" minimum) prevents contraband concealment and access. Embossed standoffs prevent distortion.

**LENS:** As specified – maximum total thickness .875" – see Ordering Information. Kenall recommends a clear outer lens with a prismatic, textured or diffused inner lens. Two clear lenses used in combination cannot be provided.

**LENS RETENTION:** Vertically adjustable continuous "Z" brackets of prime grade material, secured to housing via thru-studs (6" maximum spacing).

**HINGE:** Full length continuous heavy gauge internal piano hinge (1/2" knuckle/1/8" diameter pin) standard. Pin secured to knuckle. Hinge welded to housing and mounts to baseplate via keyholes.

**FASTENERS:** Hardened security screws as specified – see Ordering Information. Fully recessed.

**LUMINOUS SEAL:** Polyurethane foam prevents light leaks from luminaire base.

**FINISH:** TGIC polyester powder coat – 5-stage pre-treatment. Salt spray test: 1,000 hours; Reflectance: 92%.

**ELECTRICAL:** Available 3000K, 3500K, 4000K and 5000K color temperatures, 82 CRI. 120-277VAC or 347VAC, 50/60Hz electrical input with serviceable high power factor electronic, constant-current driver (<20% THD, >0.95 PF). Standard 0-10V dimming with 1-100% range and dim-to-dark capabilities (non dim-to-dark with 347V); 330 µA max. source current. LE: Lamps quantity and type as specified – see Ordering Information. Lamps supplied by others. Ballast quantity and type as specified – see Ordering Information. All ballasts UL listed class P. Optional removable reflector/lamp/ballast tray with quick disconnect.

**SENSOR & CONTROLS:** Optional sensor available with compatible third party controls. To see the full list of compatible controls, click [here](#).

**INSTALLATION:** Fixture not suitable for Surface Conduit or Continuous Row Mounting.

**WARRANTY:** Limited five (5) year warranty on LED lamps.

**LISTINGS:** UL and CUL listed for damp locations.



**ORDERING INFORMATION (Ex: SCA-4-0/0-45L40K-DCC-120-SYM/B-2-DLN)**

Model	Size	Housing/Base	Lamp Qty	Lamp Type	Driver/Ballast	Ballast Qty	Voltage	Lens (Inner/Outer)	Fasteners	Options
<b>SCA</b>										
<b>Nominal Size</b>										
2	12" x 24"		1	One						
4	12" x 48"		2	Two						
<b>Housing/Base Material</b>										
0	14-Ga CRS (Painted White)									
1	16-Ga CRS (Painted White)									
3	14-Ga SS (Painted White)									
4	16-Ga SS (Painted White)									
6*	14-Ga SS (Brushed)									
7*	16-Ga SS (Brushed)									
9	12-Ga CRS (Painted White)									
<b>Lamp Type</b>										
25L30K	25 Watt 3000K LED (82 CRI)									
25L35K	25 Watt 3500K LED (82 CRI)									
25L40K	25 Watt 4000K LED (82 CRI)									
25L50K	25 Watt 5000K LED (82 CRI)									
17	F17T8									
<b>4" Nominal Length</b>										
45L30K	45 Watt 3000K LED (82 CRI)									
45L35K	45 Watt 3500K LED (82 CRI)									
45L40K	45 Watt 4000K LED (82 CRI)									
45L50K	45 Watt 5000K LED (82 CRI)									
32	F32T8									
<b>Driver/Ballast Type</b>										
IS	Instant Start Electronic <10% THD									
RS	Rapid Start Electronic <10% THD									
SB	Specified Ballast									
DCC	Dimming Constant Current Driver									
<b>Ballast Quantity (n/a with LED)</b>										
1	One									
2	Two									
<b>Voltage</b>										
120	120 Volts									
277	277 Volts									
347	347 Volts									
DV	120-277 Volts									
<b>Fastener</b>										
1	Torx® Head w/ Center Pin									
2	Allen Head w/ Center Pin									
<b>Options</b>										
LEL	Integral 8.4W Emergency Battery Backup (4" only, n/a 347V, 0°C min ambient)									
LELST	Integral 6W Self-Testing Emergency Battery Backup (4" only, n/a 347V, 0°C min ambient)									
EL*	Standard Lumen EL Pack									
DLN	LED Night Light w/Light Level Control (100% - 20%, voltage-specific selection required; n/a with 347V)									
FS	Single Fuse & Holder									
RGT	Removable Gear Tray									
SK	Speaker Housing Extension									
	*n/a as Base Material									
	*Refer to lens specifications									
	*n/a with LED									
	*Must be paired with prismatic, textured or diffused lens when ordering LED lamps									
	*Can only be used with clear outer lens									

MATCH OTHER FIXTURES ON PROJECT



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**MIGHTY MAC™**

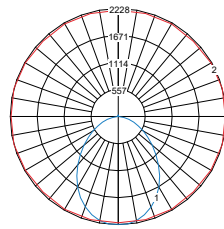
**SCA SERIES**

**PERFORMANCE**

Model	Lamp Type	Initial Delivered Lumens		Input Power (W)	Drive Current (mA)	Estd. Lto LED Life (Hrs)
		@ 25°C	Efficacy (lm/W)			
SCA-2	25L30K	2,292	81	28	117	80,000
	25L35K	2,362	83	28	117	80,000
	25L40K	2,443	89	28	117	80,000
	25L50K	2,541	92	28	117	80,000
SCA-4	45L30K	4,338	94	46	100	80,000
	45L35K	4,473	97	46	100	80,000
	45L40K	4,625	100	46	100	80,000
	45L50K	4,815	104	46	100	80,000

NOTE: All products tested with SYM/B lens configuration. See "Lumen Output Scaling Factor" table for output values with alternate lens configurations. Information subject to change without notice. Visit [www.kenall.com](http://www.kenall.com) for IES files and additional information.

Model: SCA-4-x-y-45L40K-DCC-z-SYM-B-1



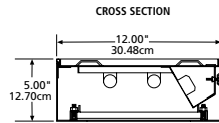
Maximum Candela = 2228 Located At Horizontal Angle = 15, Vertical Angle = 5  
 1 - Vertical Plane Through Horizontal Angles (15-195) (Through Max. Cd.)  
 2 - Horizontal Cone Through Vertical Angle (5) (Through Max. Cd.)

**LUMEN OUTPUT SCALING FACTORS**

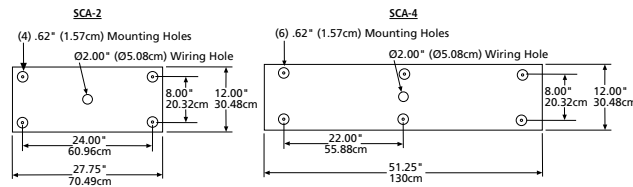
Lens Configuration	Inner Lens	Outer Lens	Scaling Factor	
SYM/G	1/8" Frost Acrylic	1/8" Clear PC	1.10	
SYM/7		3/16" Clear PC	1.06	
SYM/8		3/16" Clear TG	1.06	
SYM/9		1/4" Clear PC	1.03	
SYM/B		3/8" Clear PC	1.00	
SYM/C		3/8" Clear TG	1.03	
SYM/J		1/2" Clear PC	0.99	
1/G		1/8" Prismatic Acrylic	1/8" Clear PC	1.04
1/9			1/4" Clear PC	0.99
1/B	3/8" Clear PC		0.99	
2/J	1/2" Clear PC		0.87	

NOTE: Use this table to determine the lumen output and efficacy of the desired lens configuration by multiplying the provided value with the appropriate number in the "Performance" table above.

**DIMENSIONAL DATA**



**MOUNTING HOLES**



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**TYPE L8**  
 Other Manufacturers:  
 Paco Lighting MRGA2 Series  
 Cooper Lighting Fail-Safe FMR Series  
 New Star Lighting 57R Series

**HIGH ABUSE**  
**HASEDI SERIES – LED – INSET DOOR**

**PRODUCT FEATURES:**

- » High-output lamp sources for accurate color rendition and lighting performance
- » Diffused high-efficiency lens for reduced glare
- » Recessed ceiling mount; grid or flange - 1'x4', 2'x2', 2'x4'
- » Suitable for universal installation into 1.0" and 1.5" grid or flange (drywall) ceilings
- » One-piece inset doorframe, secured to housing with continuous piano hinge and Torx® fasteners
- » Peace of Mind Guarantee® against breakage



**SPECIFICATIONS**

**HOUSING:** 20-gauge CRS. Hole-free, one-piece, seam-welded construction. Integral aluminum heat sink for thermal dissipation. 18-gauge housing flange with mitered and welded corners. White TGIC polyester powder coat finish – 5-step pre-treatment. Salt spray test: 1,000 hours; Reflectance: 92%.

**DOORFRAME:** 18-gauge CRS. One-piece inset construction welded corners. White TGIC polyester powder coat – 5-stage pre-treatment. Salt spray test: 1,000 hours; Reflectance: 92%. Lens frame secured to housing with continuous hinge and 3 tamper-resistant stainless steel Torx® with center pin fasteners.

**LENS:** See Lens Options below to specify lens material. Lens sealed to doorframe with silicone sealant and secured with continuous lens retention system. Lens orientation – smooth side out. Minimum .187" polycarbonate lens required (max. .375") for Peace of Mind Guarantee®.

**ELECTRICAL:** Available 3000K, 3500K, 4000K and 5000K color temperatures. 120-277VAC and 347VAC, 50/60Hz electrical input with serviceable high power factor electronic, constant-current driver (<20% THD, >0.95 PF). Standard 0-10V dimming with 1-100% range and dim-to-dark capabilities (non dim-to-dark with 347V); 660 µA maximum source current.

**SENSOR & CONTROLS:** Optional sensor available with compatible third party controls. To see the full list of compatible controls, [click here](#).

**INSTALLATION:** Adjustable swing-out mounting brackets standard.

**PHOTOMETRICS:** Photometry tested to the IESNA LM-79-08 standard. For additional photometric data, please go to [www.kenall.com](#)

**WARRANTY:** Limited five (5) year LED warranty. [Peace of Mind Guarantee against breakage](#).

**LISTINGS:** Luminaire is certified to UL standards by Intertek Testing Laboratory for non-IC and Wet Location installations. ETL certified IP65 per IEC60598. CCEA approved.



**ORDERING INFORMATION (Ex: HASEDI-24-67L-40K8-DIM1-DV-2F-2H-SYM/9)**

Model	Size	Lamp Power	Lamp Color	Driver	Voltage	Doorframe	Housing	Lens Type	Options
<b>HASEDI</b>									
<b>Size</b>									
14	1'x4'	<b>Lamp Power</b>		<b>Driver Type</b>		<b>Options</b>			
22	2'x2'	1x4L	45 Watt LED	DIM1	0-10V Dimming to 1%	LEL* 8-4W Emergency Battery Pack			
24	2'x4'	45L†	67 Watt LED	<b>Voltage</b>		20KV 20KV/KA Surge Protection per IEEE/ANSI C62.41.2 Cat. A			
		67L	90 Watt LED	DV	120-277VAC, 50/60Hz	FS Fuse & Holder			
		90L		120	120VAC	HL Sealed Wireway			
		<b>2'x2'</b>		277	277VAC	IF† Install Frame			
		45LD	45 Watt Dual-Row LED	347	347VAC	PF* Plaster Frame			
		67L	67 Watt LED	<b>Doorframe Options</b>		RF* Radio Frequency Filter			
		90L	90 Watt LED	2F	18-Ga CRS in Gloss White (STD)	RM† Continuous Row Mounting			
		<b>2'x4'</b>		3F	20-Ga Type 304 SS with 48 Brushed Finish	TH 1/2" Trade Size Threaded Hub			
		45LD	45 Watt Dual-Row LED	<b>Housing/Flange Options</b>		2C Two Circuit Wiring			
		67L	67 Watt LED	2H	20-Ga CRS/18-Ga CRS in Gloss White (STD)	* Add .375" to ceiling cut out dimensions			
		90L	90 Watt LED	5H5	20-Ga Type 304 SS/18-Ga Type 304 SS with 48 Brushed Finish	† Only available when installed in drywall ceilings (flange mount)			
		135L	135 Watt LED	2H5	20-Ga CRS/18-Ga Type 304 SS with 48 Brushed Finish	• Voltage specific selection required			
		180L	180 Watt LED	<b>Lens Type</b>		‡ n/a with 2C Option			
		<b>Lamp Color</b>		G	.187" #12 Prismatic Polycarbonate	▲ n/a with 180L lamp option or 347V input; voltage-specific selection required and height of fixture is 5.875" when specified with 135L lamp option; 0°C/32°F min. operating environment.			
		30K8	3000K / 82 CRI min.	SYM/9		Symmetric, Diffused DR Acrylic inside lens .250" Clear Polycarbonate outside lens			
		35K8	3500K / 82 CRI min.	SL		Specified Lens			
		40K8	4000K / 82 CRI min.						
		50K8	5000K / 82 CRI min.						



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For additional photometry, go to [www.kenall.com](http://www.kenall.com)

**HIGH ABUSE**  
**HASEDI SERIES – LED – INSET DOOR**

PERFORMANCE		Initial Delivered Lumens		Input Power (W)	Drive Current (mA)	Estd. L70 LED Life (Hrs)
Model	Lamp Type	@ 25°C	Efficacy (lm/W)			
HASEDI14	45L-30K8	4,480	97	46	100	80,000
	45L-35K8	4,633	100			
	45L-40K8	4,776	103			
	45L-50K8	4,967	108			
	67L-30K8	6,862	95	72	75	80,000
	67L-35K8	7,096	99			
	67L-40K8	7,316	102			
	67L-50K8	7,608	106			
	90L-30K8	8,818	90	98	100	60,000
	90L-35K8	9,119	93			
90L-40K8	9,401	96				
90L-50K8	9,777	100				
HASEDI22	45LD-30K8	4,633	100	47	100	80,000
	45LD-35K8	4,792	103			
	45LD-40K8	4,940	106			
	45LD-50K8	5,137	110			
	67L-30K8	7,098	99	72	75	80,000
	67L-35K8	7,340	102			
	67L-40K8	7,567	105			
	67L-50K8	7,869	109			
	90L-30K8	9,120	93	98	100	60,000
	90L-35K8	9,431	96			
90L-40K8	9,723	99				
90L-50K8	10,112	103				
HASEDI24	45LD-30K8	5,602	123	45	50	100,000
	45LD-35K8	5,793	128			
	45LD-40K8	5,972	132			
	45LD-50K8	6,211	137	72	75	80,000
	67L-30K8	8,184	114			
	67L-35K8	8,464	118			
	67L-40K8	8,725	121			
	67L-50K8	9,074	126	94	100	60,000
	90L-30K8	10,517	112			
	90L-35K8	10,876	116			
	90L-40K8	11,212	120			
	90L-50K8	11,660	125	147	100	60,000
	135L-30K8	14,908	101			
	135L-35K8	15,417	105			
	135L-40K8	15,894	108			
	135L-50K8	16,529	112	196	100	60,000
	180L-30K8	20,328	104			
	180L-35K8	21,022	107			
180L-40K8	21,672	111				
180L-50K8	22,539	115				

Provided information includes SYM9 Lens Type. Information subject to change without notice. Visit [www.kenall.com](http://www.kenall.com) for IES files and additional information.



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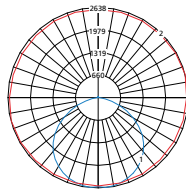
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**HIGH ABUSE**

**HASEDI SERIES – TECHNICAL DATA**

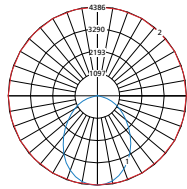
**PERFORMANCE**

Model: HASEDI-14-67L-40K8-DIM1-DV-2F-2H-SYM



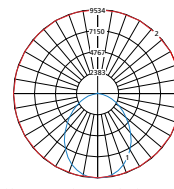
Maximum Candela = 2638 Located At Horizontal Angle = 15, Vertical Angle = 5  
 1 - Vertical Plane Through Horizontal Angles (15-195) (Through Max. Cd.)  
 2 - Horizontal Cone Through Vertical Angle (5) (Through Max. Cd.)

Model: HASEDI-22-90L-40K8-DIM1-DV-2F-2H-SYM



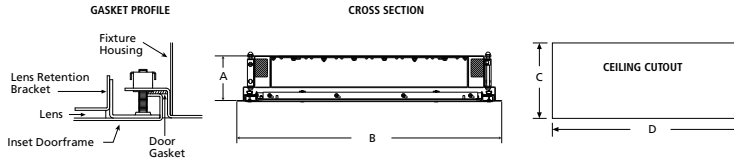
Max Candela = 4386 Located At Horizontal Angle = 0, Vertical Angle = 0  
 1 - Vertical Plane Through Horizontal Angles (0 - 180) (Through Max. Cd.)  
 2 - Horizontal Cone Through Vertical Angle (5) (Through Max. Cd.)

Model: HASEDI-24-180L-40K8-DIM1-DV-2F-2H-SYM



Max Candela = 9534 Located At Horizontal Angle = 0, Vertical Angle = 5  
 1 - Vertical Plane Through Horizontal Angles (0 - 180) (Through Max. Cd.)  
 2 - Horizontal Cone Through Vertical Angle (5) (Through Max. Cd.)

**DIMENSIONAL DATA**



**DIMENSIONAL DATA (IN INCHES)**

	A	B	C	D
1x4	4.20	11.75 x 47.75	10.85	46.85
2x2	4.20	23.75 x 23.75	22.85	22.85
2x4	4.20	23.75 x 47.75	22.85	46.85

\* Add .375" to ceiling cut out dimensions when IF Option is specified  
 \*\* Height is 5.875" with 135L lamp option when ordered in conjunction with LEL option.



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HASEDI\_14\_22\_24-072121



## WSQ LED Architectural Wall Sconce



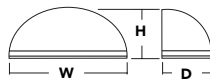
Buy American

Inverted available with  
 WLU option only.

**TYPE OL1**  
 Other Manufacturers:  
 Deco Lighting D441-LED Series  
 Cooper Lighting McGraw-Edison Impact Led Series  
 Beacon Lighting GEOPAK Series 2

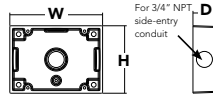
### Specifications Luminaire

**Height:** 9-3/8"  
 (23.8 cm)  
**Width:** 18"  
 (45.7 cm)  
**Depth:** 9"  
 (22.8 cm)  
**Weight:** 17 lbs  
 (7.7 kg)



### Optional Back Box (BBW)

**Height:** 4"  
 (10.2 cm)  
**Width:** 5-1/2"  
 (14.0 cm)  
**Depth:** 1-1/2"  
 (3.8 cm)



### Introduction

Classic Architectural Wall Sconce with the LED technology. Long-life, maintenance-free product with typical energy savings of 80% compared to metal halide versions. The integral battery backup option provides emergency egress lighting, without the use of a back-box or remote gear, so installations maintain their aesthetic integrity. The WSQ LED is ideal for replacing existing 50 – 250W metal halide wall-mounted products. The expected service life is 20+ years of nighttime use.

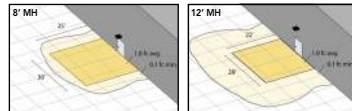
### Ordering Information

**EXAMPLE: WSQ LED P2 40K SR3 MVOLT DBBXTD**

Series	Performance Package	Color Temperature	Distribution	Voltage	Mounting	Options	Finish (required)
WSQLED	P1	30K	SR2 Type II	MVOLT <sup>1</sup>	Shipped included	<b>Shipped installed</b> PE Photoelectric cell, button type <sup>2,3</sup> SF Single fuse (120, 277, 347V) <sup>4</sup> DF Double fuse (208, 240, 480V) <sup>4</sup> DMG 0-10v dimming wires pulled outside fixture (for use with an external control, ordered separately) E20WC Emergency battery backup, Certified in CA Title 20 MAEDBS (18W, -20°C) <sup>5</sup> E10WH Emergency battery backup, Certified in CA Title 20 MAEDBS (10W, 5°C) <sup>5</sup> WLU Wet location door for up orientation <sup>6</sup> PIR Motion/ambient light sensor <sup>7</sup> DS Dual switching <sup>8</sup> SPD Separate Surge Protection <sup>9</sup> <b>Shipped separately</b> VG Vandal guard WG Wire guard	DBBXTD Dark bronze
	P2	40K	SR3 Type III	120	(blank) Surface mount		DBLXTD Black
	P3	50K	SR4 Type IV	208	Shipped separately <sup>2</sup>		DNAXD Natural aluminum
	P4			240 277 347 480	BBW Surface-mounted back box		DWHXD White DSSXD Sandstone DOBXTD Textured dark bronze DBLXTD Textured black DNATXD Textured natural aluminum DWHGXD Textured white DSSXTD Textured sandstone

### Emergency Battery Operation

The emergency battery backup (E20WC & E10WH options) is integral to the luminaire - no external housing required! This design provides reliable emergency operation while maintaining the aesthetics of the product. All E20WC & E10WH configurations include an independent secondary driver with an integral relay to immediately detect AC power loss.  
 The emergency battery will power the luminaire for a minimum duration of 90 minutes (maximum duration of three hours) from the time supply power is lost, per International Building Code Section 1006 and NFPA 101 Life Safety Code Section 7.9, provided luminaires are mounted at an appropriate height and illuminate an open space with no major obstructions.  
 The examples below show illuminance of 1 fc average and 0.1 fc minimum of the P1 power package Type IV product in emergency mode.



WSR P1 LED 40K SR4 MVOLT E20WC  
 10' x 10' Gridlines  
 8' and 12' Mounting Height

- NOTES**
- MVOLT driver operates on any line voltage from 120-277V (50/60 Hz).
  - Not available with 480V option.
  - PE option is voltage specific.
  - Single fuse (SF) requires 120V, 277V or 347V options. Double fuse (DF) requires 208V, 240V or 480V options.
  - Not available with 347V or 480V. Not available with WLU.
  - WLU not available with PIR, E20WC or E10WH.
  - When ordering PIR, "PE" will be automatically added to the order line for "dim to off" capability. See PIR Table for default settings.
  - Only available with P3 & P4 packages. Provides 50/50 luminaire operation via two independent drivers and light engines on two separate circuits. Not available with E20WC, E10WH, WLU, SF, or DF. When ordered with photocell (PE) or motion sensor (PIR), only the primary power source leads will be controlled.
  - See electrical section on page 2 for more details.



Commercial Outdoor

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WSQ-LED  
 Rev. 03/08/22

## Performance Data

### Lumen Output

Lumen values are from photometric tests performed in accordance with IESNA LM-79-08. Data is considered to be representative of the configurations shown, within the tolerances allowed by Lighting Facts.

Performance Package	System Watts (WOLT)	Dist. Type	30K (3000K, 70CRI)		40K (4000K, 70CRI)		50K (5000K, 70CRI)	
			Lumens	LPW	Lumens	LPW	Lumens	LPW
P1	20W	SR2	2,111	108	2,251	115	2,305	118
		SR3	2,104	108	2,244	115	2,298	117
		SR4	2,053	105	2,189	112	2,242	115
P2	29W	SR2	2,943	101	3,139	108	3,214	110
		SR3	2,934	101	3,129	107	3,204	110
		SR4	2,863	98	3,053	105	3,126	107
P3	40W	SR2	4,500	114	4,799	122	4,913	125
		SR3	4,486	114	4,784	122	4,898	125
		SR4	4,377	111	4,667	119	4,779	122
P4	61W	SR2	6,159	102	6,567	108	6,724	111
		SR3	6,139	101	6,547	108	6,703	110
		SR4	5,991	99	6,388	105	6,541	108

### Lumen Ambient Temperature (LAT) Multipliers

Use these factors to determine relative lumen output for average ambient temperatures from 0-40°C (32-104°F).

Ambient	Normalized Lumen Multiplier	
0°C	32°F	1.05
10°C	50°F	1.03
20°C	68°F	1.01
<b>25°C</b>	<b>77°F</b>	<b>1.00</b>
30°C	86°F	0.99
40°C	104°F	0.97

### Projected LED Lumen Maintenance

Data references the extrapolated performance projections for the MRW LED P4 platform in a 25°C ambient, based on 10,000 hours of LED testing (tested per IESNA LM-80-08 and projected per IESNA TM-21-11).

To calculate LLF, use the lumen maintenance factor that corresponds to the desired number of operating hours below. For other lumen maintenance values, contact factory.

Operating Hours	0	25000	50000	100000	L90
Lumen Maintenance Factor	1	0.96	0.95	0.92	>60000

### Electrical Load

Power Package	System Watts	Current (A)					
		120V	208V	240V	277V	347V	480V
P1	20W	0.17	0.10	0.09	0.08	0.06	0.05
P2	29W	0.26	0.15	0.13	0.12	0.09	0.07
P3	40W	0.37	0.21	0.18	0.16	0.13	0.09
P4	61W	0.59	0.33	0.28	0.25	0.19	0.14

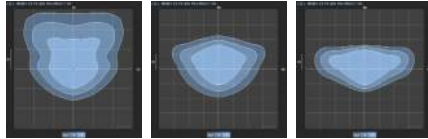
Motion/Ambient Sensor Default Settings						
Dimmed State	High Level (when triggered)	Photocell Operation	Ramp-up Time	Dwell Time	Ramp-down Time	
*PIR	3V (37%) Output	10V (100%) Output	Enabled @ 5FC	3 sec	5 min	5 min

\*PIR USES SFOD 7

## Photometric Diagrams

To see complete photometric reports or download .ies files for this product, visit Lithonia Lighting's [WSQ LED homepage](#).

Isocandela plots for the WSQ LED P4 40K SR2, SR3, and SR4. Distances are in units of mounting height (12).



## FEATURES & SPECIFICATIONS

### INTENDED USE

The classic architectural shape of the WSQ LED was designed for applications such as hospitals, schools, malls, restaurants, and commercial buildings. The long life LEDs and driver make this luminaire nearly maintenance-free.

### CONSTRUCTION

The die-cast aluminum housing integrates secondary heat sinks to optimize thermal transfer from the internal light engine heat sinks and promote long life. The driver is mounted in direct contact with the casting for a low operating temperature and long life. The die-cast door frame is fully gasketed with a one-piece solid silicone gasket to keep out moisture and dust, providing an IP65 rating for the luminaire.

### FINISH

Exterior parts are protected by a zinc-infused Super Durable TGIC thermoset powder coat finish that provides superior resistance to corrosion and weathering. A tightly controlled multi-stage process ensures a minimum 3 mils thickness for a finish that can withstand extreme climate changes without cracking or peeling. Standard Super Durable colors include dark bronze, black, natural aluminum, sandstone and white. Available in textured and non-textured finishes.

### OPTICS

Precision-molded acrylic lenses are engineered for superior distribution, uniformity, and spacing in wall-mount applications. Light engines are 4000K (70 CRI). The WSQ LED has zero uplight and qualifies as a Nighttime Friendly™ product, meaning it is consistent with the LEED® and Green Globes™ criteria for eliminating wasteful uplight.

### ELECTRICAL

Light engine(s) consist of 8 high-efficiency LEDs mounted to a metal core circuit board and integral aluminum heat sinks to maximize heat dissipation and promote long life (100,000 hrs at 25°C, L77). Class 2 electronic driver has a power factor >90%, THD <20%, and a minimum 6 KV surge protection. When ordering the SPD option, a separate surge protection device is installed within the luminaire which meets a minimum Category C low operation (per ANSI/IEEE C62.41.2).

### INSTALLATION

A universal mounting plate with integral mounting support arms allows the fixture to hinge down for easy access while making wiring connections.

### LISTINGS

CSA certified to U.S. and Canadian standards. Light engines are IP66 rated; luminaire is IP65 rated and suitable for wet locations when mounted with the lenses down. WLU option offers wet location listing in "up" orientation. Rated for -30°C minimum ambient. DesignLights Consortium® (DLC) Premium qualified product and DLC qualified product. Not all versions of this product may be DLC Premium qualified or DLC qualified. Please check the DLC Qualified Products List at [www.designlights.org/DQL](http://www.designlights.org/DQL) to confirm which versions are qualified.

### BUY AMERICAN

This product is assembled in the USA and meets the Buy America(s) government procurement requirements under FARs, DFARS and DOT. Please refer to [www.acuitybrands.com/resources/buy-american](http://www.acuitybrands.com/resources/buy-american) for additional information.

### WARRANTY

5-year limited warranty. This is the only warranty provided and no other statements in this specification sheet create any warranty of any kind. All other express and implied warranties are disclaimed. Complete warranty terms located at [www.acuitybrands.com/CustomerResources/Terms\\_and\\_conditions.aspx](http://www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx).

**Note:** Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.



Commercial Outdoor

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WSQ LED  
 Rev. 03/08/22



**TYPE X1**  
 Other Manufacturers:  
 LSL 24/7 Lighting LSINDWLEZU Series  
 Cooper Lighting UX8 Series  
 Beghelliusa FTZ Series

**FEATURES & SPECIFICATIONS**

**INTENDED USE** — Suitable for wet location (4X option), security/prisons and high-abuse applications.  
**CONSTRUCTION** — The housing is .25" to .525" thick rugged, low-profile cast aluminum.  
 Clear, UV-stable polycarbonate cover is .130" thick to prevent cracking or breaking. Cover is secured with four stainless steel, Torx T20 tamper-resistant screws with center pin. Cover is secured with four stainless steel, Phillips, head screws with the FPA option.  
 .1" thick polycarbonate faceplate incorporates universal directional chevron knockouts that are concealed and easily removed and replaced.  
 Universal mount (UM) option available — top, back, end mounting or conduit entry (canopy provided).  
 Letters 6" high with 3/4" stroke, with 100 ft viewing distance rating, based upon UL924 standards.  
**U.S. Patent No. 5,611,163 and 0383,501.**  
**OPTICS** — Lamp is constructed using new LED technology. Provides perfectly uniform illumination.  
 The typical life of the exit LED lamp is 10 years. Single-face exit uses one LED lamp; double-face exit uses two LED lamps.  
 Low energy consumption — red lamp consumes 2.3W (120V); green lamp consumes 1.7W (120V).  
**ELECTRICAL** — Dual voltage input capability (120/277V).  
**INSTALLATION** — Back mount standard for single face (no canopy), unless universal mount (UM) specified. Conduit entry (1/2" - 14 UNC) included with universal mounting.  
 Cast-aluminum canopy attaches to 10-gauge steel mounting plate for top or end mounting (not required for back mounting).  
 Canopy mounting bracket provides 160 lbs. of mounting strength when mounted to suitable structure. Bracket will only fit a 2-gang junction box.  
**LISTINGS** — UL Listed. 4X option is UL 924 wet location listed and UL listed to NEMA 4X ratings. NSF certified (FPA option). Meets UL 924, NFPA 101 (current Life Safety Code), NEC and OSHA illumination standards, and State of Minnesota energy-efficient legislation requiring less than 20W consumption. Suitable for ambient temperatures 10°C (50°F) to 40°C (104°F). Meets all applicable FCC Title 47, Part 15, Subpart B requirements.  
**BUY AMERICAN** — Product with the BAA option is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT. Please refer to [www.acuitybrands.com/buy-american](http://www.acuitybrands.com/buy-american) for additional information.  
**WARRANTY** — 5-year limited warranty. This is the only warranty provided and no other statements in this specification sheet create any warranty of any kind. All other express and implied warranties are disclaimed. Complete warranty terms located at: [www.acuitybrands.com/support/warranty/terms-and-conditions](http://www.acuitybrands.com/support/warranty/terms-and-conditions)  
 All life safety equipment, including emergency lighting for path of egress must be maintained, serviced, and tested in accordance with all National Fire Protection Association (NFPA) and local codes. Failure to perform the required maintenance, service, or testing could jeopardize the safety of occupants and will void all warranties.  
**Note:** Actual performance may differ as a result of end-user environment and application.  
 All values are design or typical values, measured under laboratory conditions at 25 °C.  
 Specifications subject to change without notice.



White on white w/red letter color

Black on black w/green letter color

**EXTREME**  
 All-Conditions Exits

**LV**

**LED LAMPS**  
 NEMA 4X Rating Available



**ORDERING INFORMATION** For shortest lead times, configure products using **bolded options**. **Example:** LV S W 1 R 120/277

LV	S	Faceplate/housing color	Number of faces	Letter color	Input voltage	Mounting	Options
<b>LV</b>	<b>S</b>	(blank) Black faceplate on black housing	1 Single face 2 Double face <sup>1</sup>	R Red G Green	120/277 Dual voltage	(blank) Back mount <sup>2</sup> UM Universal mount	(blank) None F1 Fire alarm flashing interface X2 Primary and secondary AC inputs provided <sup>3,4</sup> DL UL Listed for damp locations (10°C - 40°C) 4X UL Listed for NEMA 4X FPA Food protection area (National Sanitation Foundation Certified - splash zone) <sup>5</sup> BAA Buy America(n) Act Compliant
		W White on white WB White on black BW Black on white AB Aluminum on black AW Aluminum on white	<b>SEE PLANS</b>			<b>CONFIRM WITH PLANS</b>	

**Accessories:** Order as separate catalog number.

ELA TPS T20	Torx tamper-resistant bit for T20 center-pin screw
ELA VSA	Stem/Conduit mounting kit (see spec sheet ELA-VSA)

- Notes**
1. Available with universal mount only.
  2. Back mount standard with single face unless UM is specified. Not available on double face.
  3. UL Listed as emergency lighting equipment.
  4. Must specify input voltage (120 or 277V). Not available dual voltage.
  5. Torx tamper-resistant screws not included with FPA.

EMERGENCY

LV\_E

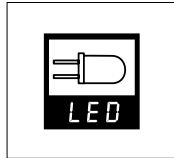
**LV LED, Extreme**

**SPECIFICATIONS**

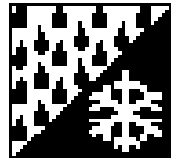
ELECTRICAL					
Primary Circuit					
Type	Typical LED life <sup>1</sup>	Supply voltage	Number of lamps <sup>2</sup>	Input watts	Max. amps
Red	10 years	120	1	2.3	.15
			2	4.6	.30
Red	10 years	277	1	2.2	.13
			2	4.4	.26
Red	10 years	347	1	1.12	.29
			2	3.16	.29
Green	10 years	120	1	1.7	.087
			2	2.8	.081
Green	10 years	277	1	1.9	.089
			2	3.3	.086

- Notes**  
 1 Based on continuous operation. The typical life of the exit LED lamp is 10 years.  
 2 Two-lamp version available with double-face only.

**KEY FEATURES**



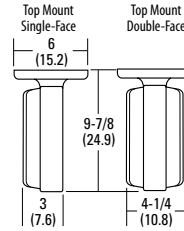
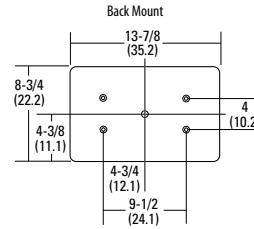
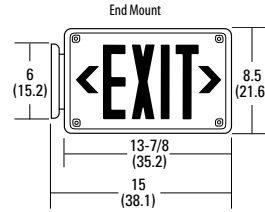
The typical life of the exit LED lamp is 10 years.



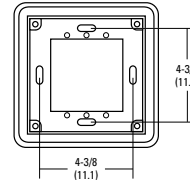
UL approved for damp or NEMA4X wet locations (see options). Cold weather — down to -40°C (LV E, N emergency only).

**MOUNTING**

All dimensions are in inches (centimeters).  
 Shipping weight: 11 lbs. (5 kgs.)



NEMA 4X Mounting Plate



Housing or canopy mounting bracket should be attached to mounting surface using suitable fastener for type of wall material. All four mounting hole positions should be used, and anchors or screws should have a minimum pullout rating of 160 lbs. Bracket will only fit a 2-gang junction box.



LV\_E

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**TYPE X**  
 Other Manufacturers:  
 LSL 24/7 Lighting LSINDWLEZU Series  
 Cooper Lighting UX6 Series  
 Beghelliusa FTZ Series

**FEATURES & SPECIFICATIONS**

**INTENDED USE** — Suitable for wet location (4X option), security/prisons and high-abuse applications.  
**CONSTRUCTION** — The housing is .25" to .525" thick rugged, low-profile cast aluminum.  
 Clear, UV-stable polycarbonate cover is .130" thick to prevent cracking or breaking. Cover is secured with four stainless steel, Torx T20 tamper-resistant screws with center pin. Cover is secured with four stainless steel, Phillips, head screws with the FPA option.  
 .1" thick polycarbonate faceplate incorporates universal directional chevron knockouts that are concealed and easily removed and replaced.  
 Universal mount (UM) option available — top, back, end mounting or conduit entry (canopy provided).  
 Letters 6" high with 3/4" stroke, with 100 ft viewing distance rating, based upon UL924 standards.  
**U.S. Patent No. 5,611,163 and 0383,501.**  
**OPTICS** — Lamp is constructed using new LED technology. Provides perfectly uniform illumination.  
 The typical life of the exit LED lamp is 10 years. Single-face exit uses one LED lamp; double-face exit uses two LED lamps.  
 Low energy consumption — red lamp consumes 2.3W (120V); green lamp consumes 1.7W (120V).  
**ELECTRICAL** — Dual voltage input capability (120/277V).  
**INSTALLATION** — Back mount standard for single face (no canopy), unless universal mount (UM) specified. Conduit entry (1/2" - 14 UNC) included with universal mounting.  
 Cast-aluminum canopy attaches to 10-gauge steel mounting plate for top or end mounting (not required for back mounting).  
 Canopy mounting bracket provides 160 lbs. of mounting strength when mounted to suitable structure. Bracket will only fit a 2-gang junction box.  
**LISTINGS** — UL Listed. 4X option is UL 924 wet location listed and UL listed to NEMA 4X ratings. NSF certified (FPA option). Meets UL 924, NFPA 101 (current Life Safety Code), NEC and OSHA illumination standards, and State of Minnesota energy-efficient legislation requiring less than 20W consumption. Suitable for ambient temperatures 10°C (50°F) to 40°C (104°F). Meets all applicable FCC Title 47, Part 15, Subpart B requirements.  
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 All life safety equipment, including emergency lighting for path of egress must be maintained, serviced, and tested in accordance with all National Fire Protection Association (NFPA) and local codes. Failure to perform the required maintenance, service, or testing could jeopardize the safety of occupants and will void all warranties.  
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White on white w/red letter color



Black on black w/green letter color

**EXTREME**

All-Conditions Exits

**LV**

**LED LAMPS**  
 NEMA 4X Rating Available



**ORDERING INFORMATION** For shortest lead times, configure products using **bolded options**. **Example:** LV S W 1 R 120/277

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		W White on white WB White on black BW Black on white AB Aluminum on black AW Aluminum on white	<b>SEE PLANS</b>			<b>CONFIRM WITH PLANS</b>	

**Accessories:** Order as separate catalog number.

ELA TPS T20	Torx tamper-resistant bit for T20 center-pin screw
ELA VSA	Stem/Conduit mounting kit (see spec sheet <a href="#">ELA-VSA</a> )

- Notes**
1. Available with universal mount only.
  2. Back mount standard with single face unless UM is specified. Not available on double face.
  3. UL Listed as emergency lighting equipment.
  4. Must specify input voltage (120 or 277V). Not available dual voltage.
  5. Torx tamper-resistant screws not included with FPA.

EMERGENCY

LV\_E



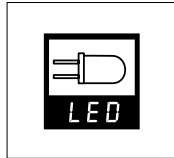
**LV LED, Extreme**

**SPECIFICATIONS**

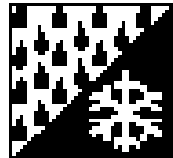
ELECTRICAL					
Primary Circuit					
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Red	10 years	120	1	2.3	.15
			2	4.6	.30
Red	10 years	277	1	2.2	.13
			2	4.4	.26
Red	10 years	347	1	1.12	.29
			2	3.16	.29
Green	10 years	120	1	1.7	.087
			2	2.8	.081
Green	10 years	277	1	1.9	.089
			2	3.3	.086

- Notes**  
 1 Based on continuous operation. The typical life of the exit LED lamp is 10 years.  
 2 Two-lamp version available with double-face only.

**KEY FEATURES**



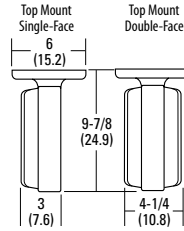
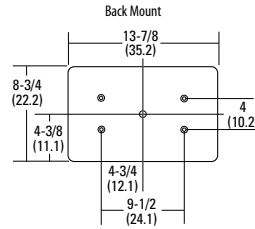
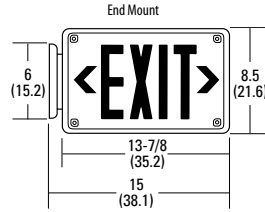
The typical life of the exit LED lamp is 10 years.



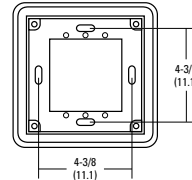
UL approved for damp or NEMA4X wet locations (see options). Cold weather — down to -40°C (LV E, N emergency only).

**MOUNTING**

All dimensions are in inches (centimeters).  
 Shipping weight: 11 lbs. (5 kgs.)



NEMA 4X Mounting Plate



Housing or canopy mounting bracket should be attached to mounting surface using suitable fastener for type of wall material. All four mounting hole positions should be used, and anchors or screws should have a minimum pullout rating of 160 lbs. Bracket will only fit a 2-gang junction box.



LV\_E

EMERGENCY: One Lithonia Way, Conyers, GA 30012 Phone: 800-705-SERV (7378) www.lithonia.com techsupport-emergency@acuitybrands.com © 1996-2022 Acuity Brands Lighting, Inc. All rights reserved. Rev. 06/14/22

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 26 Section "Electrical General Requirements."

## 1.2 SUMMARY

- A. This Section includes design and installation of a new fire alarm system, and smoke pressurization control system.
- B. Related Sections include the following:
  - 1. Division 8 Section "Door Hardware" for door closers and holders with associated smoke detectors, electric door locks, and release devices that interface with the fire alarm system.

## 1.3 DEFINITIONS

- A. FACP: Fire alarm control panel.
- B. LED: Light-emitting diode.
- C. NICET: National Institute for Certification in Engineering Technologies.
- D. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

## 1.4 SYSTEM DESCRIPTION

- A. Noncoded, analog-addressable system; automatic sensitivity control of certain smoke detectors; and multiplexed signal transmission dedicated to fire alarm service only.
- B. Fire alarm system shall consist of the following:
  - 1. All new fire alarm control panel, devices, and wiring.
  - 2. System smoke detection above all control panels and notification appliance power supply panels.
  - 3. System smoke detection as required at air handling units, smoke rated transfer openings, and smoke damper locations.
  - 4. System smoke detection in areas identified on plans.
  - 5. All flow and tamper switches to monitor fire sprinkler and standpipe systems and report appropriate alarm and supervisory signals.
  - 6. Manual fire alarm boxes at each building exit (prior to entering exit stairwells at each floor).
  - 7. Audible and visual notification appliances in all public and common areas of the building.
  - 8. Emergency Generator Monitoring.
  - 9. Control and monitoring of stair pressurization fans and smoke control systems.
  - 10. Firefighter communication system.

## 1.5 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 72.
- B. Comply with NFPA 70.
- C. A complete functional system meeting the requirements of this specification, including alarm initiating devices and notification appliances at locations and ratings to meet

the requirements of the Authorities Having Jurisdiction and all applicable codes shall be provided.

- D. Coordinate and avoid conflicts with casework, markerboards, feature walls, and other areas where fire alarm devices would interfere with furnishings, finishes, etc.
- E. Fire alarm system vendor shall provide sound pressure level calculations demonstrating compliance with NFPA 72 and establish quantities and tap settings of audible devices.
- F. No additional charges for work or equipment required for a code compliant system approved by the Authority Having Jurisdiction will be allowed.
- G. Obtain and refer to mechanical drawings for smoke damper locations, smoke rated transfer openings, and air handling equipment CFM's. Provide smoke detection as required by applicable codes.
- H. Premises protection includes B, I3, and S-2 Type building use group.
  - 1. Refer to drawings for complete code analysis including construction type, use groups, special occupancy types, rated walls, smoke barriers and partitions, etc.
- I. System functional performance shall be as indicated on the fire alarm matrix on the drawings.

## 1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
  - 1. Shop Drawings shall be prepared by persons with the following qualifications:
    - a. Trained and certified by manufacturer in fire alarm system design.
    - b. Fire alarm certified by NICET, minimum Level III.
  - 2. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
  - 3. Device Address List: Include address descriptions that will appear on the FACP display.
  - 4. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
  - 5. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show wiring color code.
  - 6. Batteries: Provide battery sizing calculations. Battery size shall be a minimum of 125% of the calculated requirement.
  - 7. Duct Smoke Detectors: Performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
  - 8. Ductwork Coordination Drawings: Plans, sections, and elevations of ducts, drawn to scale and coordinating the installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling

- tubes, the detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
9. Voice/Alarm Signaling Service: Equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
  10. Floor Plans: Indicate final outlet locations showing address of each addressable device. Show device layout, size and route of cable and conduits.
- C. Qualification Data: For Installer.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For fire alarm system to include in emergency, operation, and maintenance manuals. Comply with NFPA 72, Appendix A, recommendations for Owner's manual. Include abbreviated operating instructions for mounting at the FACP.
- F. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 1 Section "Submittals," make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.
- G. Documentation:
1. Approval and Acceptance: Provide the "Record of Completion" form according to NFPA 72 to Owner, Architect, and Authorities Having Jurisdiction.
  2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Owner, Architect, and authorities having jurisdiction. Format of the written sequence of operation shall be the optional input/output matrix.
    - a. Hard copies on paper to Owner, Architect, and Authorities Having Jurisdiction.
    - b. Electronic media may be provided to Architect.
- 1.7 QUALITY ASSURANCE
- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
  - B. Installer Qualifications: Work of this Section be performed by a UL-listed company.
  - C. Installer Qualifications: Personnel certified by NICET as Fire Alarm Level III.
  - D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- 1.8 EXTRA MATERIALS
- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but not less than 1 unit.
2. Smoke, Fire, and Flame Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than 1 unit of each type.
3. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than 1 unit of each type.
4. Keys and Tools: One extra set for access to locked and tamperproofed components.
5. Audible and Visual Notification Appliances: One of each type installed.
6. Fuses: Two of each type installed in the system.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. FACP and Equipment:
    - a. Edwards Systems Technology Inc.
    - b. NOTIFIER; a Honeywell Company.
    - c. Siemens Building Technologies, Inc.; a Cerberus Division.
    - d. SimplexGrinnell LP; a Tyco International Company.
    - e. Gamewell-FCI; a Honeywell Company.
    - f. National Time & Signal.
    - g. Xtralis.

### 2.2 FACP

- A. General Description:
1. Modular, power-limited design with electronic modules, UL 864, 9<sup>th</sup> edition, listed.
  2. Addressable initiation devices that communicate device identity and status.
    - a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at the FACP.
    - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
  3. Addressable control circuits for operation of mechanical equipment.
  4. Mounting: Surface.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
  2. Keypad: Arranged to permit entry and execution of programming, display, and control commands; and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:

1. Signaling Line Circuits from control panel to devices: NFPA 72, Class B, Style 4.
  - a. System Layout: Install no more than 50 addressable devices on each signaling line circuit.
2. Notification-Appliance Circuits: NFPA 72, Class B, Style Y.
3. Actuation of alarm notification appliances, emergency voice communications, annunciation, smoke pressurization control, smoke control, elevator recall, and actuation of suppression systems shall occur within 10 seconds after the activation of an initiating device.
4. Electrical monitoring for the integrity of wiring external to the FACP for mechanical equipment shutdown and magnetic door-holding circuits is not required, provided a break in the circuit will cause doors to close and mechanical equipment to shut down.

D. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm verification" signal at the FACP.
2. Activate a listed and approved "alarm verification" sequence at the FACP and the detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel FACP indication and system reset if the alarm is not verified.

E. Power Supply for Supervision Equipment: Supply for audible and visual equipment for supervision of the ac power shall be from a dedicated dc power supply, and power for the dc component shall be from the ac supply.

F. Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP and remote annunciators, after initiating devices are restored to normal.

1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.

G. Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password. The FACP and annunciators shall display a test indication while the test is underway. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.

H. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and control of changes in those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and make a print-out of the final adjusted values on the system printer.

- I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through a digital alarm communicator transmitter and telephone lines.
- J. Voice/Alarm Signaling Service: A central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a special module that is part of the FACP.
  - 1. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones, or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall be UL 1711 listed.
    - a. Allow the application of and evacuation signal to indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
    - b. Programmable tone and message sequence selection.
    - c. Standard digitally recorded messages for "Evacuation" and "All Clear."
    - d. Generate tones to be sequenced with audio messages of the type recommended by NFPA 72 and that are compatible with tone patterns of the notification-appliance circuits of the FACP.
  - 2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
  - 3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.
- K. Service Modem: The dial-in port shall allow remote access to the FACP for programming changes and system diagnostic routines. Access by a remote terminal shall be by encrypted password algorithm.
- L. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble), and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including the same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
- M. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signal, supervisory and digital alarm communicator transmitter shall be powered by the 24-V dc source.
  - 1. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
  - 2. Power supply shall have a dedicated fused safety switch for this connection at the service entrance equipment. Paint the switch box red and identify it with "FIRE ALARM SYSTEM POWER."
- N. Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.
  - 1. Battery and Charger Capacity: Comply with NFPA 72.
- O. Surge Protection:
  - 1. Install surge protectors recommended by FACP manufacturer. Install on all system wiring external to the building housing the FACP.



- P. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

## 2.3 FIREFIGHTERS' SMOKE-CONTROL SYSTEM

- A. Initiate Smoke-Management Sequence of Operation:
  - 1. Comply with sequence of operation as described in Division 23 Section "Sequence of Operations for HVAC DDC."
  - 2. Fire-alarm system shall provide all interfaces and control points required to properly activate smoke-management systems.
  - 3. First fire-alarm system initiating device to go into alarm condition shall activate the smoke-control functions.
  - 4. Subsequent devices going into alarm condition shall have no effect on the smoke-control mode.
- B. Addressable Relay Modules:
  - 1. Provide address-setting means on the module. Store an internal identifying code for control panel use to identify the module type.
  - 2. Allow the control panel to switch the relay contacts on command.
  - 3. Have a minimum of two normally open and two normally closed contacts available for field wiring.
  - 4. Listed for controlling HVAC fan motor controllers.

## 2.4 MANUAL FIRE ALARM BOXES

- A. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.
  - 1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP. Double action pull stations shall meet ADA guidelines.
  - 2. Station Reset: Key- or wrench-operated switch.
  - 3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
  - 4. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm.

## 2.5 SYSTEM SMOKE DETECTORS

- A. General Description:
  - 1. UL 268 listed, operating at 24-V dc, nominal.
  - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
  - 3. Multipurpose type, containing the following:

- a. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
    - b. Heat sensor, combination rate-of-rise and fixed temperature.
  4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring.
  5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
  6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status.
  7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
    - a. Rate-of-rise temperature characteristic shall be selectable at the FACP for 15 or 20 deg F per minute.
    - b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at the FACP to operate at 135 or 155 deg F.
    - c. Provide multiple levels of detection sensitivity for each sensor.
- B. Photoelectric Smoke Detectors:
1. Sensor: LED or infrared light source with matching silicon-cell receiver.
  2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
- C. Duct Smoke Detectors:
1. Photoelectric Smoke Detectors:
    - a. Sensor: LED or infrared light source with matching silicon-cell receiver.
    - b. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
  2. UL 268A listed, operating at 24-V dc, nominal.
  3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
  4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
    - a. Weatherproof Duct Housing Enclosure: UL listed for use with the supplied detector. The enclosure shall comply with NEMA 250 requirements for Type 4X.
  5. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
  6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status. Provide remote status and alarm indicator and test station where required.
  7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
  8. Each sensor shall have multiple levels of detection sensitivity.

9. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
10. Relay Fan Shutdown: Provide two (2) sets of contacts rated to interrupt fan motor-control circuit.

## 2.6 HEAT DETECTORS

- A. General: UL 521 listed.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or rate-of-rise of temperature that exceeds 15 deg F per minute, unless otherwise indicated.
  1. Mounting: Plug-in base, interchangeable with smoke-detector bases.
  2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
- C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.
  1. Mounting: Plug-in base, interchangeable with smoke-detector bases.
  2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

## 2.7 NOTIFICATION APPLIANCES

- A. Description: Equipped for mounting as indicated and with screw terminals for system connections.
  1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
  2. Finishes:
    - a. Wall mounted appliances: Provide red finish with white lettering.
    - b. Ceiling Mounted Appliances: Provide white finish.
- B. Voice/Tone Speakers:
  1. UL 1480 listed.
  2. High-Range Units: Rated 2 to 15 W.
  3. Low-Range Units: Rated 1 to 2 W.
  4. Matching Transformers: Tap range matched to the acoustical environment of the speaker location.
- C. Visible Alarm Devices: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
  1. Rated Light Output: 15, 30, 60, 75, 110, 135, 185 candela as required to meet NFPA 72 requirements.
  2. Strobe Leads: Factory connected to screw terminals.

## 2.8 FIREFIGHTERS' TWO-WAY TELEPHONE COMMUNICATION SERVICE

- A. Dedicated, two-way, supervised, telephone voice communication links between the FACP, the Fire Command Center, and remote firefighters' telephone stations. Supervised telephone lines shall be connected to talk circuits by controls in a control module. Provide the following:
1. Common-talk type for firefighter use only.
  2. Selective-talk type for use by firefighters and fire wardens.
  3. Controls to disconnect phones from talk circuits if too many phones are in use simultaneously.
  4. Audible Pulse and Tone Generator, and High-Intensity Lamp: When a remote telephone is activated, it causes audible signal to sound and high-intensity lamp to flash.
  5. Selector panel controls simultaneous operation of telephones in selected zones and permits up to six phones to be operated simultaneously. Indicate ground faults and open or shorted telephone lines on the panel front by individual LEDs.
  6. Provide liquid-crystal digital display to indicate location of caller.
  7. Remote Telephone Cabinet: Flush or surface-mounted cabinet, as indicated, factory-standard red finish, with handset.
    - a. Install one-piece handset to cabinet with vandal-resistant armored cord. Silk-screened or engraved label on cabinet door, designation "Fire Warden Phone" or "Fire Emergency Phone."
    - b. With "break-glass" type door access lock.
  8. Remote Telephone Jack Stations: Single-gang, stainless-steel-plate mounted plug, engraved "Fire Warden Phone" or "Fire Emergency Phone."
  9. Handsets: Provide push-to-talk type sets with noise-canceling microphone. Provide 3 handsets stored in a cabinet adjacent to the FACP.

## 2.9 REMOTE STATUS AND ALARM INDICATORS

- A. Remote status and alarm indicator and test stations, with LED indicating lights. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single-gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device initiating the signal and room where the smoke detector or valve is located. For water-flow switches, the identification plate also designates protected spaces downstream from the water-flow switch.

## 2.10 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching door plate.
1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
  2. Wall-Mounted Units: Flush mounted, unless otherwise indicated.
  3. Rating: 24-V ac or dc.
  4. Rating: 120-V ac.
- B. Material and Finish: Match door hardware.

#### 2.11 REMOTE ANNUNCIATOR

- A. Description: Duplicate annunciator functions of the FACP for alarm, supervisory, and trouble indications. Also duplicate manual switching functions of the FACP, including acknowledging, silencing, resetting, and testing.
  - 1. Mounting: Surface cabinet, NEMA 250, Class 1.
- B. Display Type and Functional Performance: Alphanumeric display same as the FACP. Controls with associated LEDs permit acknowledging, silencing, resetting, and testing functions for alarm, supervisory, and trouble signals identical to those in the FACP.

#### 2.12 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.

#### 2.13 ADDRESSABLE CONTROL MODULE

- A. Provide for integration of auxiliary control functions into the analog signaling circuit. Intelligent analog signaling circuit control module shall have the following capabilities:
  - 1. Communication interaction with the analog signaling circuit having the capability of initiating a control function to an auxiliary device based on a specified event.
  - 2. Provide NO/NC contact pairs rated at 2 amps 120 VAC or 24 VDC.

#### 2.14 SYSTEM PRINTER

- A. Listed and labeled as an integral part of the fire alarm system.

#### 2.15 GUARDS FOR PHYSICAL PROTECTION

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
  - 1. Factory fabricated and furnished by manufacturer of the device.
  - 2. Finish: Paint of color to match the protected device.

#### 2.16 WIRE AND CABLE

- A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.
- B. Fire alarm wire and cable shall be as specified by the system manufacturer including conductor gage, conductor quantity, conductor twists and shielding required to meet NFPA class and style performance specified.
- C. Signaling Line Circuits and other power limited fire alarm circuits (PLFA):

1. PLFA circuits installed in conduit or raceway: U.L. Listed type FPL
2. PLFA circuit cable installed exposed in accessible ceiling spaces, risers and elsewhere: U.L. Listed type FPLP.
3. PLFA circuits installed where 2 hr rating is required to meet the survivability requirements of NFPA 72: Circuit integrity cable, NFPA 70 Article 760, Classification CI, UL listed as Type FPL, FPLR or FPLP as required, and complying with requirements in UL 1424 and in UL 2196 for a 2-hour rating.

D. Non-Power-Limited Fire Alarm Circuits (NPLFA):

1. NPLFA circuits installed in conduit: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
  - a. Low-Voltage Circuits: No. 16 AWG, minimum.
  - b. Line-Voltage Circuits: No. 12 AWG, minimum.
2. NPLFA circuit cable installed exposed in ceiling spaces, risers and elsewhere: Multi-conductor cable, U.L Listed type NPLFP.
3. NPLFA circuits installed where 2 hr rating is required to meet the survivability requirements of NFPA 72: Multi-conductor cable, U.L Listed type NPLFP-CI
4. NPLFA circuit cable installed exposed in ceiling spaces, shafts and elsewhere: Multi-conductor Armored Cable, NFPA 70 Type MC, copper conductors, copper drain wire, aluminum or steel armor with red identifier stripe, UL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

## PART 3 - EXECUTION

### 3.1 EQUIPMENT INSTALLATION

A. Smoke or Heat Detector Spacing:

1. Smooth ceiling spacing shall not exceed 30 feet or the listed spacing of the detectors, whichever is less.
2. Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.
3. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.

B. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.

C. Duct Smoke Detectors: Comply with NFPA 72. Install sampling tubes so they extend the full width of the duct.

D. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

E. Remote Status and Alarm Indicators: Install near each smoke detector, each duct detector and each sprinkler water-flow switch and valve-tamper switch that is above 10'-0" aff, concealed, or otherwise not readily visible from normal viewing position. Coordinate exact locations with local fire department and submit to architect for approval.

- F. Audible Alarm Notification Appliances: Install wall mounted appliances not less than 6 inches below the ceiling.
- G. Visible Alarm Notification Appliances: Install wall mounted appliances at 96" AFF or 6 inches below the ceiling, whichever is less.
- H. Coordinate ceiling mounted appliances with reflected ceiling plans. Do not install visual appliances where pendant mounted or suspended lighting fixtures will obstruct intended viewing angles.
- I. Install wall mounted and ceiling mounted notification appliances flush on recessed j-box or back box for all new work and on existing gyp-board partition walls.
- J. Install notification appliances on existing CMU walls on surface back-boxes matching the dimensions and finish of the notification appliance.
- K. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- L. FACP: Surface mounted with tops of cabinets not more than 72 inches above the finished floor.
  - 1. Install smoke detector above panel. Install on ceiling for ceilings under 10 ft. For ceilings above 10', wall mount a smoke detector listed for releasing service 10' AFF or 1' below finished ceiling (whichever is lower).
- M. Annunciator: Install with top of panel not more than 72 inches above the finished floor.
- N. Provide all 120V branch circuits for all control panels, sub panels, and ancillary equipment required for the system.

### 3.2 WIRING INSTALLATION

- A. Install wiring according to the following:
  - 1. NECA 1.
  - 2. TIA/EIA 568-A.
- B. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceways and Boxes."
  - 1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
- C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

- D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- E. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- F. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum 1-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
- G. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Electrical Identification."
- B. Install instructions frame in a location visible from the FACP.
- C. Paint power-supply disconnect switch red and label "FIRE ALARM."

### 3.4 GROUNDING

- A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

### 3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
  - 2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.
    - a. Include the existing system in tests and inspections.
  - 3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.



4. Testing: Follow procedure and record results complying with requirements in NFPA 72.
  - a. Detectors that are outside their marked sensitivity range shall be replaced.
5. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

### 3.6 PROGRAMMING

- A. Coordinate final address descriptions for alarm, supervisory and trouble indication that appear on FACP and Annunciator displays with the Owners representative. This shall include all room names, room numbers, building areas for fire protection zones, exit door descriptions and similar items. This coordination shall take place and be implemented in the programming prior to Demonstration and Owner Training.

### 3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.
- B. Follow-Up Tests and Inspections: After date of Substantial Completion, test the fire alarm system complying with testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for three monthly, and one quarterly, periods.
- C. Annual Test and Inspection: One year after date of Substantial Completion, test the fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for monthly, quarterly, semiannual, and annual periods. Use forms developed for initial tests and inspections.

### 3.8 WARRANTY

- A. All newly installed equipment shall be warranted by the contractor for a period of one year following acceptance. The warranty shall include parts, labor, prompt field service, pickup and delivery.

### 3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 283100

SECTION 311001  
CLEARING AND REMOVAL OF MISCELLANEOUS STRUCTURES

PART 1 - GENERAL

1.01 Work Included

This work includes, but is not limited to, clearing, topsoil removal, tree and stump removal, and the removal and protection of miscellaneous items within the project area.

1.02 Related Work

A. Section 024113.13 – Pavement Removal

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.01 Location of Underground Utilities

The Contractor shall call MISS DIG at least three work days before excavating in an area so that utility companies can identify their buried utilities. The Contractor shall notify area municipalities and other utilities in the area that do not participate in the MISS DIG program for location of their utilities.

3.02 Stripping and Stockpiling of Topsoil

Prior to excavating, the existing topsoil surface shall be stripped and stockpiled from within the limits of the proposed excavation.

3.03 Removal of Fences, Signs, Mailboxes, Ornaments, and Other Objects

Fences, signs, mailboxes, ornaments, and similar objects that fall within the project area shall either be protected or removed. If removed, the materials shall be carefully taken apart and stored in a place where they will not be damaged or stolen.

Where mailboxes are removed, a temporary mailbox shall be installed and maintained by the Contractor until the permanent one is replaced.

Traffic signs shall not be removed unless approved by the agency responsible for them. If approved for removal, traffic signs and posts shall be reinstalled in accordance with the requirements of the agency responsible for them.

If any of the materials to be removed are damaged or badly deteriorated before the Contractor removes them, the Contractor shall notify the Engineer before the object is removed. Materials

that are damaged, stolen, or lost after they have been removed shall be replaced by the Contractor at no increase in project cost.

#### 3.04 Conflicts with Utility Poles

Where the proposed excavation requires that a pole or guy be supported or temporarily relocated, the Contractor shall make arrangements with the appropriate utility to have the pole or guy supported or relocated. Any costs for this shall be the Contractor's expense.

If the Contractor supports the pole or relocates the guy themselves, the method used shall meet the approval of the appropriate utility.

#### 3.05 Trees and Brush

Brush lying within the limits of the proposed excavation shall be cleared by the Contractor. Brush shall be removed from the project area and disposed of properly.

Trees lying within the limits of the proposed excavation that are to be removed shall be cut down by the Contractor. Plans may not show all trees of all nature and the Contractor shall become familiar with the project and base their work on their own assessment. The Contractor shall coordinate with the Owner as to which trees are to be left in place and those that will be acceptable to remove. The Contractor shall notify the property owner (or the adjacent property owner if the tree is located in a public right-of-way) in advance of cutting down tree(s). The wood from the tree(s) shall be offered to the landowner. If the landowner wants the wood, the tree shall be cut into sections 8 feet long and stacked adjacent to the project area.

Small branches, limbs, and other debris shall be removed from the area by the Contractor and disposed of properly. If the landowner does not want wood from the trees, all wood including branches, limbs, and other debris shall be removed from the area by the Contractor and disposed of properly.

Stumps shall be removed in their entirety and disposed of away from the project area in an acceptable manner. Burning or burying along the project route is not acceptable.

END OF SECTION 311001

SECTION 312301  
EXCAVATING, FILLING, AND GRADING

PART 1 - GENERAL

1.01 Work Included

The work of excavating, filling, and grading includes, but is not necessarily limited to:

- A. Excavating for footings and foundations;
- B. Filling and backfilling to attain indicated grades;
- C. Trenching and trench backfilling;
- D. Rough and finish grading of the site; and
- E. Furnishing and installing granular cushion under concrete slabs on grade.

1.02 References

Where materials or methods of construction are listed as being in conformance with a standard specification, it shall refer to the latest edition of the standard specification or any interim revision.

- A. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- B. Michigan Department of Transportation 2020 Standard Specifications for Construction

1.03 Related Work

- A. Section 014516.02 – Density and Aggregate Testing
- B. Section 015726 – Dust Control
- C. Section 024113.13 – Pavement Removal
- D. Section 312500 – Soil Erosion and Sedimentation Control

1.04 Job Conditions

A. Dust Control

Dust caused by the Contractor's operations during performance of the work, or resulting from the condition in which the Contractor leaves the site, shall be controlled by the Contractor. The Contractor shall use all means necessary to control dust on and near the work zone and all off-site borrow areas.

All surfaces shall be thoroughly moistened, as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on the site.

B. Protection

The Contractor shall use all means necessary to protect all materials before, during, and after installation and to protect all objects designated to remain.

In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

C. Safety

The Contractor is responsible for conducting operations in a safe and orderly manner and in conformance with MIOSHA P.A. 154.

D. Permits

Unless otherwise provided, the Contractor is responsible to obtain and comply with permits required under Parts 31 and 91 of Michigan PA 451 of 1994 (Natural Resources and Environmental Protection Act) and any local ordinances.

PART 2 - PRODUCTS

2.01 Fill Material – General

All fill material shall be subject to the approval of the Engineer.

For approval of fill material, notify the Engineer at least four working days in advance of intention to import material, designate the proposed borrow area, and permit the Engineer to sample, as necessary, from the borrow area for the purpose of making acceptance tests to prove the quality of the material.

2.02 Fill, Trench, and Structural Backfill Material

Fill material, unless specified otherwise, shall be soil or soil-rock mixture that is free from organic matter and other deleterious substance. It shall contain no rocks or lumps over 6 inches in greatest dimension and not more than 15 percent of the rocks or lumps shall be larger than 2½ inches in greatest dimension.

Fill material obtained from offsite sources shall meet the requirements of the preceding paragraph and additionally, shall be predominantly granular with a maximum particle size of 2 inches and a plasticity index of 12 or less.

Fill material placed within 2 feet horizontally of the base of building foundations and/or slabs shall have a plasticity index of 15 or less.

2.03 Sand

Sand shall meet the requirements of Granular Material Class II, as specified in the Michigan Department of Transportation 2020 Standard Specifications for Construction.

2.04 Granular Cushion

Granular cushion under slabs shall meet the requirements of Granular Material Class II, as specified in the Michigan Department of Transportation 2020 Standard Specifications for Construction.

2.05 Sand for Backfill

Sand shall meet the requirements of Granular Material Class II, as specified in the Michigan Department of Transportation 2020 Standard Specifications for Construction.

2.06 Stone for Pipe Bedding

Stone shall meet the requirements of Series 6A aggregate, as specified in the Michigan Department of Transportation 2020 Standard Specifications for Construction.

2.07 Stone for Backfill

Stone shall meet the requirements of 21AA crushed aggregate or 4G open-graded aggregate, as specified in the Michigan Department of Transportation 2020 Standard Specifications for Construction.

2.08 Flowable Fill

Flowable fill shall be a mixture of Portland cement, fly ash, sand, and water in the following proportions.

<b>Flowable Fill Mixture Ratios</b>		
<b>Material</b>	<b>Type</b>	<b>Quantity</b>
Portland Cement	Type I or IA	50 lb/cyd
Fly Ash	ASTM C618, Class C or F	500 lb/cyd
Sand	MDOT 2NS	2,850 lb/cyd
Water		Approx. 376 lb/cyd (sufficient to produce desired flowability)

Flowable fill shall be produced and delivered at a minimum temperature of 50 degrees Fahrenheit. Mixtures shall be transported to the point of placement in a revolving drum mixer or agitator.

2.09 Geotextile

Geosynthetics must be composed of long-chain synthetic fiber of at least 85 percent, by weight, polyolefins or polyesters. Geosynthetics must be capable of resisting degradation from chemicals, mildew, rot, and ultraviolet (UV) light.

Geotextile used to prevent intermixing of soft subgrade and subbase materials shall meet the requirements per the Michigan Department of Transportation 2020 Standard Specifications for Construction, as shown in Table 910-1 for geotextile stabilization and separator.

#### 2.10 Other Materials

All other materials not specifically described, but required for a complete and proper installation, shall be as selected by the Contractor and subject to the approval of the Engineer.

### PART 3 - EXECUTION

#### 3.01 General

Prior to all work of this section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this section. The Contractor shall not allow or cause any of the work performed or installed to be covered up or enclosed by work of this section prior to all required inspections, tests, and approvals. Should any of the work be enclosed or covered up before it has been approved, the Contractor shall uncover all such work at no additional cost to the Owner. After the work has been completely tested, inspected, and approved, the Contractor shall make all repairs and replacements necessary to restore the work to the condition in which it was found at the time of uncovering, all at no additional cost to the Owner.

The Contractor shall excavate ahead of the proposed utility installation to expose any existing buried utilities. If existing utility grades conflict with the proposed utility grade, the proposed utility grade may be adjusted by the Engineer, if necessary, to miss the existing utility grade at no additional expense to the contract.

#### 3.02 Geotextile Stabilization and Geotextile Separator

Deliver and store geosynthetics in packaging capable of resisting UV radiation, contaminants, and moisture. Label each unit of material with product information, including supplier and lot identification. Do not expose geosynthetics to direct sunlight for prolonged periods. Repair or replace damaged geosynthetics at no additional cost to the project.

##### A. Geotextile Placement

Place or install geotextile products in accordance with the manufacturer's installation guidelines and this subsection.

Do not operate equipment required to place backfill directly on geotextile products. Eliminate wrinkles or waves that develop during placement. Place the products in direct contact with the soil below before placing backfill on the geotextile products.

Shingle-lap longitudinal and transverse joints at least 2 feet, or seam the joints in accordance with the manufacturer's recommendations. Ensure field or factory seams meet the minimum

grab tensile strength for the product application. Place seams facing upward for inspection purposes.

Repair tears or damage to the geotextile in accordance with the manufacturer's recommendations.

**B. Aggregate or Granular Material Placement**

Spread and grade the first layer of aggregate or granular material after placing geotextile to create a stable work platform before compaction. Place additional aggregate or granular material, as required, and compact. Fill ruts with additional aggregate or granular material and compact before placing each subsequent layer. The cost of aggregate or granular material, including additional quantities required to fill ruts, is included in the unit prices for related pay item(s).

**3.03 Excavating**

Where depressions result from, or have resulted from, the removal of surface or subsurface obstructions, the Contractor shall open the depression and remove all debris and soft material as directed by the Engineer.

The Contractor shall excavate to the grades shown on the drawings. Where excavation grades are not shown on the drawings, excavation shall be completed, as required, to accommodate the installation.

All over-excavated areas shall be backfilled and compacted at no additional cost to the Owner.

**3.04 Preparation of Subgrade**

After the site has been cleared, stripped, and excavated to within 6 inches of the specified depths for recompaction, the exposed surface shall be scarified to a minimum depth of 6 inches, thoroughly moisture-conditioned, and compacted to the requirements specified below for fill.

All ruts, hummocks, and other uneven surfaces shall be removed by surface grading prior to placement of fill.

**3.05 Subgrade Undercutting**

Subgrade undercutting shall be performed to replace material susceptible to frost heaving, differential frost action, or unstable soil conditions, as determined by the Engineer.

After the subgrade has been excavated to the approximate grade, the Engineer will inspect the grade to determine if subgrade undercutting is required and to determine the limits of such undercutting. The Contractor shall provide suitable equipment for proof rolling the grade. The inspection, proof rolling, and subgrade undercutting shall be completed prior to placing any embankment, road base, or pavement.



The Contractor shall undercut the subgrade within the limits defined by the Engineer. All excavated material resulting from the undercutting shall become the Contractor's property disposed of outside the project limits, unless otherwise directed. The volume of earth removed by subgrade undercutting shall be replaced by suitable soils as follows:

- A. Type I Subgrade Undercutting - backfill with selected clay or similar material approved by the Engineer.
- B. Type II Subgrade Undercutting - backfill with sand.
- C. Type III Subgrade Undercutting  
Backfill with the material excavated from subgrade undercut areas after mixing the excavated material to break up the undesirable strata of soils or with other Engineer-approved backfill material.
- D. Type IV Subgrade Undercutting  
Backfill with 21AA crushed aggregate or 4G open-graded aggregate. Encapsulate 4G aggregate with geotextile separator.

Backfill material shall be compacted according to Section 014516.02 – Density and Aggregate Testing.

### 3.06 Excess Water Control

Fill material shall not be placed, spread, or rolled during unfavorable weather conditions. Operations shall not resume until moisture content and fill density are satisfactory to the Engineer. Berms or channels shall be provided to prevent flooding of subgrade. All water collecting in depressions shall be promptly removed.

Where soil has been softened or eroded by flooding or placement during unfavorable weather, all damaged areas shall be removed and compacted as specified below for fill and compaction.

The Contractor shall provide suitable means and equipment to maintain excavations and other parts of the work free from water.

Dewatering means and methods shall provide dry excavations and the preservation of the final lines and grades of bottoms of excavations.

### 3.07 Fill and Compaction

After subgrade compaction has been approved by the Engineer, the Contractor shall place approved fill material in layers not exceeding 10 inches in uncompacted thickness.

The fill material shall be watered or aerated, as necessary, and thoroughly mixed to obtain a moisture content that will permit proper compaction.

Each soil layer shall be compacted to at least the specified minimum degree. The filling and compaction process shall be repeated until plan grade is attained.

A. Compaction Requirements

Unless otherwise specified on the drawings or in other sections of the specifications, fill and backfill shall be placed in 8-inch lifts and each lift shall be compacted to not less than the percentages of the maximum density stated in Section 014516.02 – Density and Aggregate Testing.

Compaction by jetting will not be permitted unless specifically authorized by the Engineer.

3.08 Grading

Except as otherwise directed by the Engineer, the Contractor shall perform all rough and finish grading required to attain the elevations shown on the drawings.

<b>Tolerances For Grading</b>			
<b>Rough Grade</b>		<b>Finish Grade</b>	
Building, roads, and parking areas	Plus or minus 0.1 feet	Granular cushion under concrete slabs	Plus or minus 0.05 feet
Landscaped areas	Plus or minus 0.25 feet	Parking areas	Plus or minus 0.03 feet
		Landscaped areas	Plus or minus 0.1 feet

After grading is completed and has been accepted by the Engineer, the Contractor shall permit no further excavating, filling, or grading.

The Contractor shall use all means necessary to prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

3.09 Excavating for Footings

Earth surfaces, upon which footings will be placed, shall be compacted in accordance with the compaction requirements established in this section of these specifications.

The Contractor shall verify that all compaction is complete and approved prior to excavating for footings.

The Contractor shall excavate to the required lines and grades. The bottom of trenches shall be cut level and all loose soil shall be removed. Where soft spots are encountered, unsuitable materials shall be removed and replaced with flowable fill at no additional cost to the Owner.

### 3.10 Placing Granular Cushion

The Contractor shall carefully place the specified granular cushion in areas to receive concrete slabs on grade, uniformly attaining the thickness indicated on the drawings, and providing all required transition planes.

### 3.11 Trenching

The Contractor shall perform all trenching required for the installation of items where the trenching is not specifically described in other sections of these specifications.

All trenches shall be open construction, with sufficient width to provide free working space at both sides of the trench and around the installed item as required for pipelaying, backfilling, and compacting.

Trenching shall be completed, as required, to provide the elevations shown on the drawings. Where elevations are not shown on the drawings, trench to sufficient depth to give a minimum of 18 inches of fill above the top of the pipe, measured from the adjacent finished grade.

Where trench excavation is inadvertently carried below proper elevations, the over-excavated area shall be backfilled with material approved by the Engineer, and then compacted to provide a firm and unyielding subgrade and/or foundation to the approval of the Engineer and at no additional cost to the Owner.

The Contractor shall properly support all trenches in accordance with all applicable rules and regulations.

The Contractor shall brace, sheet, and support trench walls in such a manner that they will be safe and that the ground alongside the excavation will not slide or settle, and that all existing improvements of every kind, whether on public or private property, will be fully protected from damage.

In the event of damage to such improvements, the Contractor shall immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

Bracing, sheeting, and shoring shall be constructed so as to not place stress on any portion of the completed work until the general construction thereof has proceeded far enough to provide sufficient strength. The Contractor shall exercise care in the drawing and removal of sheeting, shoring, bracing, and timbering to prevent collapse and caving of the excavation faces being supported.

Trenched material shall be stockpiled in a manner to prevent water running into the excavations. Surface drainage shall not be obstructed. A means shall be provided whereby storm and wastewaters are diverted into existing gutters, other surface drains, or temporary drains.

### 3.12 Foundation for Pipes

Trench bottoms shall be graded to provide a smooth, firm, and stable foundation free from rock points throughout the length of the pipe.

A minimum of 4 inches of sand or stone bedding shall be placed in the bottom of the trench.

In areas where soft, unstable materials are encountered at the surface where the bedding is to be placed, the unstable material shall be removed and replaced with material approved by the Engineer. The area shall be undercut to a sufficient depth to develop a firm foundation for the item being installed. Over excavation and replacement of material shall be the responsibility of the Contractor and shall be completed at no additional cost to the Owner.

At each joint in pipe, the bottom of the trench shall be recessed, as required, to relieve the bell of the pipe of all load and to ensure continuous bearing of the pipe barrel on the firm foundation.

The pipe subgrade shall be shaped to fit the bottom of the trench to the pipe shape.

### 3.13 Bedding for Pipes

The specified bedding shall be placed in the trench, simultaneously on each side of the pipe for the full width of the trench, to a depth of at least 12 inches over the outside diameter of the pipe barrel.

The bedding material shall be compacted after placing along both sides of the pipe.

Firm bedding support on the underside of the pipe and fittings shall be provided for the full length of the pipe.

### 3.14 Backfill for Pipes

After the pipe has been thoroughly bedded and covered, suitable excavated material shall be placed in uniform lifts of not more than 10 inches in uncompacted thickness and then compacted as specified in this section. The spreading and compacting procedure shall be repeated until the adjacent grade level is attained. Backfill material shall be sand when in the influence of structures, pavement, or utilities.

### 3.15 Miscellaneous Pipe Repair

When an existing sewer pipe, drain pipe, field tile, or other existing pipe is damaged as a result of construction activities and is not designated for removal or abandonment on the plans or by the Engineer, it shall be repaired by the Contractor.

The section of damaged pipe shall be removed to existing joints or to sawed joints where the existing pipe is sound and undamaged. A length of new pipe of the same size as the original pipe

shall be furnished and installed to replace the section of pipe removed. The new pipe may be any one of the following materials:

- A. Same material, class or thicknesses, as the original pipe
- B. PVC Schedule 40, for pipes 8 inches or less in diameter
- C. PVC SDR 26, for pipes 8 inches or greater in diameter
- D. Other pipe material approved by the Engineer

Each end of the new section of pipe shall be connected to the remaining sections of existing pipe using a rubber gasketed sleeve, suitable for the pipe materials and sizes being joined, to provide a watertight connection. The repaired section of pipe shall be firmly bedded in sand or stone, compacted according to Section 014516.02 – Density and Aggregate Testing.

END OF SECTION 312301

SECTION 312500  
SOIL EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 Work Included

The Contractor shall provide permanent and/or temporary erosion and sedimentation control as called for on the plans and as required by the county soil erosion agent and permit.

1.02 Definitions

A. Major rainfall event – ¼-inch or more precipitation over a period, delineated by dry periods of at least 24 hours.

1.03 References

Where materials or methods of construction are listed as being in conformance with a standard specification, it shall refer to the latest edition of the standard specification or any interim revision.

- A. ASTM D3786 – Standard Test Method for Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method
- B. ASTM D4355 – Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
- C. ASTM D4491 – Standard Test Method for Water Permeability of Geotextiles by Permittivity
- D. ASTM D4533 – Standard Test Method for Trapezoid Tearing Strength of Geotextiles
- E. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
- F. ASTM D4751 – Standard Test Method for Determining Apparent Opening Size of a Geotextile
- G. ASTM D4833 – Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
- H. Michigan Department of Transportation 2020 Standard Specifications for Construction

1.04 Related Work

- A. Section 015726 – Dust Control
- B. Section 329200 – Turf Establishment

1.05 Permit

The Contractor shall apply for and obtain an Act 451 permit from the local Soil Erosion and Sedimentation Control Enforcing Agent. The Contractor shall pay all permit fees and provide any required bonds or insurance.

1.06 Scheduling

- A. Control measures shall be constructed by the Contractor prior to the time construction starts uphill or upstream from the control measure location.
- B. The Contractor shall inspect all temporary erosion control measures weekly and within 18 hours of major rainfall events.
- C. Maintenance and replacement of erosion control measures shall be completed by the Contractor when necessary, or as directed by the soil erosion control agent or the Engineer.
- D. Removal and cleanup of temporary control structures shall be provided by the Contractor within one week after the control measure is no longer needed.

1.07 General Soil Erosion and Sedimentation Content Procedures

- A. Keep disturbed areas small.
- B. Stabilize and protect disturbed areas as soon as possible.
- C. Keep storm water runoff velocities low.
- D. Protect disturbed areas from runoff.
- E. Retain sediment within the construction area.

PART 2 - PRODUCTS

2.01 Materials

A. Geotextiles

Geotextiles for filters shall be non-woven, meeting the requirements of the table below.

Silt fence geotextiles shall meet the requirements of the following table and shall be designed to collect eroded sediment transported in storm water runoff. The fabric shall have at least 70 percent minimum retained strength after 500 hours of U.V. exposure when tested according to ASTM D4355.

Geotextile Category	Property/Test Method					
	Grab Tensile Strength (min) ASTM D4632 lbs	Trapezoid Tear Strength (min) ASTM D4533 lbs	Puncture Strength (min) ASTM D4833 lbs	Mullen burst strength (min) ASTM D3786 psi (a)	Permittivity ASTM D4491 Per second	Apparent Opening Size (max) ASTM D4751 (b) Millimeters
Filters	90	45	45	140	0.5	0.21
Silt Fence	100(c)	45	--	--	0.1	0.60

	Property/Test Method					
	Grab Tensile Strength (min) ASTM D4632 lbs	Trapezoid Tear Strength (min) ASTM D4533 lbs	Puncture Strength (min) ASTM D4833 lbs	Mullen burst strength (min) ASTM D3786 psi (a)	Permittivity ASTM D4491 Per second	Apparent Opening Size (max) ASTM D4751 (b) Millimeters
<b>Geotextile Category</b>						
(a) ASTM D3786. The fluid displacement rate for the Mullen burst test equipment must be 170± 5 ml/minute. Subtract tare strength from the ultimate burst strength as specified by ASTM.						
(b) Filtration opening size (FOS, Canadian General Standards Board, method 148.1 No. 10) is permitted as an alternate test method to ASTM D4751 for non-woven geotextiles.						
(c) Elongation at the specified grab tensile strength not to exceed 40 percent for silt fence.						

B. Stone

Unless otherwise directed, stone shall meet the requirements of Series 6A as specified in Michigan Department of Transportation 2020 Standard Specifications for Construction.

2.02 Mixtures

A. Seed

Seed shall meet the requirements of Section 329200 – Turf Establishment.

2.03 Fabricated Items

A. Silt Fence

Geotextile for silt fences shall meet the requirements of Section 2.01. The geotextile shall be attached to machine pointed No. 2 common grade hardwood posts, using at least 5 staples through wood lath a minimum of 3/8-inch thick and 2 feet long. Post spacing shall not exceed 6 1/2 feet. Posts must be of sufficient length and cross-section to support the installed silt fence under full sediment load; however, posts shall have cross-sectional area of at least 2 1/4 square inches and shall be a minimum of 36 inches in length. Silt fence fabric must be a minimum height of 2 1/2 feet. Silt fence shall have at least two permanent markings or affixed labels per assembled roll which positively identifies the fabricator.

B. Mulch Blankets

Mulch blankets shall meet the requirements of Section 329200 – Turf Establishment.

C. Filter Sacks

All materials shall adhere to the requirements of the Michigan Department of Transportation 2020 Standard Specifications for Construction, except fabric drop, which shall consist of a geotextile filter sack inserted into the drainage structure under the cover.

Filter sack shall be as manufactured by “Siltsack”, “Catch-All”, “Ultra-Urban Filter”, “Flogard + Plus”, or approved equal. The filter sacks shall be installed and maintained in accordance with the manufacturer’s specifications.



### PART 3 - EXECUTION

#### 3.01 General Requirements

The Contractor shall perform work on the project in a manner which prevents or reduces erosion and controls sedimentation. The Contractor shall provide controls which keep sedimentation from the project area, within the limits of the project area, and out of any lake, river, stream, wetland, or storm drain.

The Contractor shall install appropriate controls or measures to control or prevent erosion or sedimentation from the project area before beginning any earth disturbance operations. Temporary erosion and sedimentation control measures shall be maintained by the Contractor, until such times as disturbed areas have become permanently stabilized.

During the life of the project, the Contractor shall provide any additional soil erosion or sedimentation control measures necessary to address specific problems which develop in and adjacent to the project area.

#### 3.02 Time Limitations

Grading operations shall be completed as soon as practical. Permanent soil erosion controls for disturbed areas shall be completed within 5 calendar days of the completion of grading, except that permanent measures shall be completed within 24 hours when the disturbed area is within 150 feet of a lake, stream, river, or wetland area.

Temporary soil erosion measures shall be implemented when it is not practical to complete the permanent measures.

#### 3.03 Area Limitations

For linear projects (roads, sewers, water main, etc.), the length of the disturbed area shall be limited to ½-mile, unless otherwise approved by the Engineer.

Areas outside the project right-of-way or outside the grading limits shown on the drawings shall not be disturbed, unless otherwise approved by the Engineer.

#### 3.04 Construction of Erosion and Sedimentation Controls

The Contractor shall provide all permanent and temporary erosion and sedimentation controls shown on the drawings, required by the permitting agency, or necessary to appropriately control erosion and sedimentation from the project area.

##### A. Check Dams

Check dams shall be installed and maintained across ditches and watercourses, which might convey surface runoff from disturbed areas within the project area, or where shown on the drawings or required by the Engineer or permitting agency.

B. Silt Fence

The Contractor shall furnish, erect, and maintain silt fence around the perimeter of the project area where earth will be disturbed and sediment from the disturbed area could be conveyed.

C. Filters

Fabric or stone filters shall be installed in waterways or in advance of inlets to drainage courses or storm sewers.

D. Sediment Traps and Basins

Sediment traps shall be excavated upstream of check dams and where shown on the drawings or directed by the Engineer or permitting agency. Check dams shall be installed downstream of the sediment traps and basins prior to the sediment traps and basins being excavated.

E. Seeding

Earth areas shall be stabilized with turf immediately following the completion of earthwork and grading activities. Where permanent seeding cannot be completed, earth areas shall be stabilized with temporary seeding. Areas which are properly seeded temporarily for stabilization shall be permanently seeded, as shown, as the work can be appropriately completed.

F. Mulch Blankets

Areas susceptible to erosion from moving water, which are not to be paved, shall be seeded and protected with high velocity mulch blankets.

3.05 Maintenance and Erosion and Sedimentation Control

The Contractor shall maintain all temporary erosion and sedimentation controls until such time as the permanent measures have been completed and established.

The Contractor shall inspect all erosion and sedimentation controls weekly and within 18 hours of a major rain event.

Damaged controls or measures shall be replaced or repaired. Sediment shall be cleaned from traps, sumps, basins, filters, and fences periodically. Sediment shall be removed to prevent the accumulation of sediment from exceeding half of the volume of traps, sumps, and basins. Sediment or debris along silt fences shall be removed before the accumulation reaches half the height of the fence.

Sediment and debris removed from soil erosion and sedimentation control devices shall be disposed of properly by the Contractor. Sediment shall not be used for fill or backfill in the project area, except when an area is specifically designated on the plans or by the Engineer.

Drainage filters shall be cleaned when an accumulation of silt might reduce flow and result in flooding.

Any sediment from the construction area which enters storm sewers or drainage ditches shall be

removed by the Contractor. Since sediment can be carried great distances within storm sewers, it may be necessary for many segments of downstream storm sewer segments to be televised, jetted, and vacuumed. If the Engineer believes that the Contractor has allowed or provided the potential for sediment to enter storm sewers or drainage courses, the Contractor will be responsible for the costs of inspection and removing sediment from downstream drains, whether it can be conclusively proven that the sediment was the result of the Contractor's actions (or inaction).

### 3.06 Removal of Erosion and Sedimentation Control Devices

Temporary soil erosion and sedimentation control devices shall be removed or obliterated by the Contractor when the permanent measures are in place and established. Any areas damaged by the removal of the temporary devices shall be corrected by the Contractor.

Mulch used for temporary erosion control may either be removed or worked into the soil before the permanent topsoil and seeding is completed.

END OF SECTION 312500

SECTION 321116  
GRANULAR SUBBASE

PART 1 - GENERAL

1.01 Work Included

This specification describes the requirements for constructing granular subbase under a proposed aggregate surface.

1.02 References

A. Michigan Department of Transportation 2020 Standard Specifications for Construction

1.03 Related Work

A. Section 014516.02 – Density and Aggregate Testing

PART 2 -PRODUCTS

2.01 Materials

A. Granular subbase shall meet the requirements of Class II Sand, as described in the Michigan Department of Transportation 2020 Standard Specifications for Construction, unless otherwise noted on the plans, proposal, or specifications.

PART 3 - EXECUTION

3.01 Subgrade Preparation

Granular subbase shall not be placed until the subgrade is properly prepared. The subgrade shall be graded to the required elevations and shape for placement of the specified granular subbase thickness. The subgrade shall be compacted according to Section 014516.02 – Density and Aggregate Testing. Soft or yielding spots shall be excavated and replaced with sound material.

3.02 Placement

Granular subbase shall be placed in a manner that provides a uniform cross section of the specified thickness and the required surface grades. The edges of the area of granular subbase shall be straight and uniform.

Material shall not be placed over frozen, soft, unstable, or rutted subgrade.

Granular subbase shall be placed in lifts not exceeding 12 inches (loose measure) and compacted according to Section 014516.02 – Density and Aggregate Testing.

END OF SECTION 321116

SECTION 321123  
AGGREGATE BASE

PART 1 - GENERAL

1.01 Work Included

This specification describes the requirements for constructing an aggregate base under a proposed pavement surface.

1.02 References

A. Michigan Department of Transportation 2020 Standard Specifications for Construction

1.03 Related Work

A. Section 014516.02 – Density and Aggregate Testing

B. Section 312301 – Excavating, Filling, and Grading

PART 2 - PRODUCTS

2.01 Materials

A. Aggregate shall be crushed limestone and meet the requirements of Series 21AA aggregate, as described in the Michigan Department of Transportation 2020 Standard Specifications for Construction, unless otherwise noted on the plans, proposal, or specifications.

PART 3 - EXECUTION

3.01 Subgrade Preparation

Aggregate shall not be placed until the subgrade is properly prepared. The subgrade shall be graded to the required elevations and shape for placement of the specified aggregate thickness. The subgrade shall be compacted according to Section 014516.02 – Density and Aggregate Testing. Soft or yielding spots shall be excavated and replaced with sound material.

3.02 Placement

Aggregate shall be placed in a manner that provides a uniform cross section of the specified thickness and the required surface grades. The edges of the area of aggregate surface shall be straight and uniform.

Aggregate shall be placed in lifts not exceeding 8 inches (loose measure) and compacted according to Section 014516.02 – Density and Aggregate Testing.

END OF SECTION 321123

SECTION 321216  
HMA PAVING

PART 1 - GENERAL

1.01 Work Included

This work includes preparation for and construction of one or more courses of plant mixed Hot Mix Asphalt (HMA).

1.02 References

- A. Michigan Department of Transportation 2020 Standard Specifications for Construction
- B. Michigan Testing Methods (MTM)
- C. Michigan Department of Transportation HMA Production Manual

1.03 Related Work

- A. Section 014516.02 – Density and Aggregate Testing
- B. Section 321123 – Aggregate Base
- C. Section 330500 – Adjusting Structures

1.04 Quality Assurance and Quality Control

- A. The Contractor will take 20,000 gram samples of the HMA mixture using the mini-stockpile method. The rate of sampling will be determined by the Engineer.

PART 2 - PRODUCTS

2.01 Submittals

The Contractor shall submit material source and mix designs to the Engineer for approval prior to the start of construction.

2.02 Mixtures

Materials shall meet the requirements of Section 501.02 of the Michigan Department of Transportation 2020 Standard Specifications for Construction. If milling, the mix design to initially cover the milled surface must be approved prior to milling operations.

Provide aggregates, mineral filler (if required) and asphalt binder to produce a mixture proportioned within the master gradation limits shown in the contract, and meeting the uniformity tolerance limits in the Uniformity Tolerance Limits for HMA Mixtures table below.

Uniformity Tolerance Limits for HMA Mixtures					
Parameter		Top and Leveling Course		Base Course	
Number	Description	Range 1 (a)	Range 2 (b)	Range 1 (a)	Range 2 (b)
1	% Binder Content	-0.3 to +.4	+/- 0.5	-0.3 to +0.4	+/- 0.5
2	% passing # 8 and Larger Sieves	+/- 5	+/-8	+/- 7	+/- 9
		+/- 4	+/- 6	+/-6	+/-9
		+/- 1	+/- 2	+/- 2	+/- 3
3	Crushed Particle Content	Below 10%	Below 15%	Below 10%	Below 15%
(a) This range allows for normal mixture and testing variations. The mixture must be proportioned to test as closely as possible to the Job-Mix-Formula (JMF).					
(b) Deviation from JMF.					

Parameter Number 2, as shown in the Uniformity Tolerance Limits for HMA Mixtures table, is aggregate gradation. Each sieve will be evaluated on one of the three gradation tolerances. If more than one sieve is exceeding Range 1 or Range 2 tolerances, only the one with the largest exceedance will be counted as the gradation parameter.

The master gradation should be maintained throughout production; however, price adjustments will be based on the Uniformity Tolerance Limits for HMA Mixtures table. Aggregates which are used in plant-mixed HMA mixtures must not contain topsoil, clay, or loam.

The mixture will be considered out-of-specification, as determined by the acceptance tests, if for any one mixture, two consecutive tests per parameter, (for Parameter 2, two consecutive aggregate gradations on one sieve) are outside Range 1 or Range 2 tolerance limits. If a parameter is outside of Range 1 tolerance limits and the second consecutive test shows that the parameter is outside of Range 2, then it will be considered to be a Range 1 out-of-specification. Consecutive refers to the production order and not necessarily the testing order. Out-of-specification mixtures are subject to a price adjustment of 50 percent of the bid amount.

Reclaimed Asphalt Pavement (RAP) shall be limited to 0 percent to 17 percent RAP by weight of the total binder in the mixture. No binder grade adjustment is made to compensate for the stiffness of the asphalt binder in the RAP.

Reclaimed Asphalt Shingles (RAS) will not be allowed in the mixture.

Oil bottoms/recycled motor oil will not be allowed in the mixture.

### PART 3 - EXECUTION

#### 3.01 Equipment

Equipment shall meet the requirements of Section 501.03 of the Michigan Department of Transportation 2020 Standard Specifications for Construction.

### 3.02 HMA Sampling and Testing

The Contractor shall submit to the Engineer for approval the rate at which the HMA will be sampled. Samples will be obtained using the "Mini-stockpile" method in accordance with MTM 324.

Quantitative Extraction of Bitumen from HMA Paving Mixtures (MTM 325) will be used to determine the asphalt content of the HMA mixture.

The Contractor is responsible for HMA testing.

The Contractor shall submit test results to the Engineer within seven days of HMA placement.

At the Engineer's discretion, original samples of asphalt binder will be taken by the Contractor and delivered to the Engineer prior to incorporation into the mixture. The frequency of sampling will be determined by the Engineer. The cost of obtaining and delivering the samples to the Engineer will be included in the HMA pay item(s). The Contractor must certify, in writing, that the materials used in the HMA mixture are from the same source as the materials used in developing the HMA mixture design and the bond coat is from an approved supplier, as stated in the Material Quality Assurance Procedures Manual.

### 3.03 Preparation

#### A. Aggregate Base (for Pavements Constructed on an Aggregate Base)

See Section 321123 – Aggregate Base.

#### B. Existing Pavement (for Overlays)

The existing pavement surface shall be thoroughly cleaned of all dirt and debris. Loose material shall be removed from all joints and cracks using compressed air, or other suitable means that does not damage the existing pavement.

The existing pavement surface shall be observed by the Engineer prior to placement of a bond coat or HMA.

#### C. Removal of Existing Pavement Surface

##### 1. Butt Joints

When a butt joint is to be provided, the existing HMA surface shall be removed to a thickness equal to the thickness of the proposed overlay, for the full width of the butt joint, where the overlay is to meet the existing pavement surface. The depth of pavement removal shall be uniformly tapered from the full depth of the overlay at the butt joint to zero, at a rate of 1-inch per 10 feet.

##### 2. Edge Trimming

Where the edge of an existing HMA pavement is required, the HMA pavement shall be cut its full depth in a manner that provides a vertical, straight edge.



3. Cold Milling

Cold milling shall be performed only when the Contractor is prepared to commence subsequent operations, such as pavement repair and HMA placement, and completes these subsequent operations expeditiously.

The HMA surface shall be removed to the required depth, width, grade, and cross section. The surface shall be removed to the limits shown on the plans, or as directed by the Engineer.

Where the HMA surface is removed below the limits specified, the Contractor shall fill and compact the area removed so that the remaining surface is at the proper level. The work to restore the pavement to the required level will be at the Contractor's expense.

After cold milling, and before placement of a new surface, the pavement shall be thoroughly cleaned.

D. Joint and Crack Repair

Joints and cracks in an existing pavement shall be repaired where shown on the drawings, or directed by the Engineer. Joints and cracks shall be repaired in accordance with the details shown on the drawings, or as directed by the Engineer.

All loose, broken, and unsound pavement along or adjacent to an existing joint or crack designated for repair shall be removed.

E. Hand Patching

When hand patching is called for on the plans or directed by the Engineer, the Contractor shall fill holes, depressions, joints and cracks, and areas to be repaired in an existing pavement. HMA material used for hand patching may be any HMA material approved for use as a top course. A bond coat shall be applied to the exposed pavement surfaces within the area to be patched. The HMA material shall be placed in lifts to the level of the surface of the adjacent existing pavement surface. Each lift shall be within the minimum and maximum thickness range allowed for the mix design, and shall be compacted using a mechanical vibrator or an approved roller.

F. Bond Coat

Bond coat shall be applied to existing pavement surfaces, only when they are clean and dry. Bond coats shall be uniformly applied to the pavement surface with a pressure applicator. Bond coat shall be placed in advance of HMA placement to provide for its curing prior to HMA placement.

Bond coat shall not be allowed to pool on the surface; pooling shall be removed. The adjacent pavement surfaces which are not to be overlaid shall not be sprayed with bond coat.

Bond coat shall be applied to each layer of the HMA pavement and to the vertical edges of the adjacent pavements before placing subsequent courses.

G. Transportation of HMA

HMA shall be transported to the project site in accordance with the requirements of Section 501.03.E of the Michigan Department of Transportation 2020 Standard Specifications for Construction.

Each load of HMA delivered to the project site shall be weighed on an approved scale with automatic print out system. Weights shall be measured to the nearest 20 pounds. Scales and print out systems shall meet the requirements of Section 109 of the Michigan Department of Transportation 2020 Standard Specifications for Construction.

H. Placement of HMA

HMA shall be placed in accordance with the requirements of Section 501.03.F of the Michigan Department of Transportation 2020 Standard Specifications for Construction and at the rate shown in the HMA Application Rate table in the project plans.

I. Rolling

HMA shall be rolled in accordance with the requirements of Section 501.03.G of the Michigan Department of Transportation 2020 Standard Specifications for Construction.

J. Smoothness requirements as per the requirements of Section 501.03.H of the Michigan Department of Transportation 2020 Standard Specifications for Construction shall be adhered to.

K. Weather and Seasonal Limitations

1. The Contractor shall not place bond coat or HMA when precipitation is imminent or when there is moisture on the existing surface to be overlaid.
2. HMA shall not be placed when the underlying base is frozen, and the surface being paved is at least 35 degrees Fahrenheit.
3. Unless otherwise approved by the Engineer in writing, HMA shall not be placed before May 15 or after November 15.

L. Protection

The Contractor shall protect surfaces, structures, signs, poles, vehicles, and other items adjacent to the area to be paved from being discolored or damaged. Damaged items shall be corrected at the Contractor's expense. The Contractor shall protect the newly placed HMA surface from damage by traffic and construction activities.

M. Aggregate Shoulders

On resurfacing projects, existing aggregate shoulders shall be scarified prior to placing new aggregate.

Shoulders shall be maintained in a satisfactory condition to allow for vehicles to pass construction operations or for the operation of construction equipment. The Contractor shall restore any damages or disturbances to the shoulders, or to the surface between the edge of

pavement and the right-of-way. The cost of restoration is considered included in the other work performed by the Contractor and will not be paid for separately.

N. Adjustment of Castings, Manholes, Monument Boxes, Water Valves, and Water Shutoffs

Castings, manholes, water valves, and water shutoffs shall be adjusted in accordance with Section 330500 – Adjusting Structures.

Monument boxes shall be installed or adjusted after placement of the final HMA course, in accordance with Section 330500 – Adjusting Structures.

END OF SECTION 321216

SECTION 321300  
CONCRETE CURB AND GUTTER, SIDEWALK,  
AND MISCELLANEOUS PAVEMENT

PART 1 - GENERAL

1.01 Work Included

This work includes all preparation, forming, concrete production and placement, finishing, jointing, reinforcing, curing, protection, and restoration for the construction of concrete curb and gutter, sidewalk, and miscellaneous pavement.

1.02 References

Where materials or methods of construction are listed as being in conformance with a standard specification, it shall refer to the latest edition of the standard specification or any interim revision.

- A. ASTM A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
- B. ASTM C94 – Standard Specification for Ready-Mixed Concrete
- C. ASTM C150 – Standard Specification for Portland Cement
- D. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- E. ASTM A706, ASTM A615, or ASTM A996 (Type R or Type A only) for Grade 60 steel bars
- F. ASTM A775 for epoxy coated steel reinforcement
- G. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- H. Michigan Department of Transportation 2020 Standard Specifications for Construction
- I. Michigan Department of Transportation Standard Plan

1.03 Related Work

- A. Section 014516.01 – Concrete Testing
- B. Section 014516.02 – Density and Aggregate Testing
- C. Section 024113.13 – Pavement Removal

## PART 2 - PRODUCTS

### 2.01 Materials

- A. Portland cement shall meet the requirements of ASTM C150.
- B. Coarse aggregate shall meet the requirements of Class 6A aggregate, as described in the Michigan Department of Transportation 2020 Standard Specifications for Construction.
- C. Reinforcing steel fabric shall meet the requirements of ASTM A1064.
- D. Deformed bars must meet the requirements of ASTM A706, ASTM A615, or ASTM A996 (Type R or Type A only) for Grade 60 steel bars, unless otherwise required. All deformed bars shall be epoxy coated.
- E. Epoxy coated steel reinforcement must be coated in accordance with ASTM A775.
- F. White membrane curing compound shall conform to ASTM C309, Type 2. Curing compound shall be agitated to provide a uniform consistency prior to transfer between containers or before application.
- G. Fiber joint filler shall meet the requirements of ASTM D1751.
- H. Sand for base shall meet the requirements of Granular Material Class II, as described in the Michigan Department of Transportation 2020 Standard Specifications for Construction.
- I. The detectable warning surface shall contrast visually with adjacent walking surfaces. The Contractor shall submit the detectable warning product information to the Engineer for approval.
- J. Geotextile liner shall meet the requirements per the Michigan Department of Transportation 2020 Standard Specifications for Construction, as shown in Table 910-1 for physical requirements of geotextile.

### 2.02 Mixtures

Concrete shall be transit mixed 3,500 psi concrete in accordance with ASTM C94 and Section 014516.01 – Concrete Testing.

Air content, slump, and compressive strength shall be according to Section 014516.01 – Concrete Testing. Concrete shall contain at least six sacks of cement per cubic yard of concrete. Modifications and the use of admixtures may be submitted and shall be approved by the Engineer.

### 2.03 Submittals

- A. Prior to beginning construction, the Contractor shall submit the name and plant location of the proposed concrete supplier for the project.
- B. Prior to beginning construction, the Contractor shall submit mix designs for the proposed concrete mixtures proposed for use on the project for the Engineer to review.

## 2.04 Cross Sections

### A. Sidewalk

Unless indicated otherwise on the plans, sidewalk shall have a minimum thickness of 4 inches. Sidewalk through residential driveways shall have a minimum thickness of 6 inches. Sidewalk through commercial driveways shall have a minimum thickness of 8 inches. Sidewalk through driveways shall be reinforced with #10 by 6 inches by 6 inches welded wire fabric.

### B. Driveways

Unless indicated otherwise on the plans, residential driveways shall have a minimum thickness of 6 inches. Commercial driveways shall have a minimum thickness of 8 inches. Driveways shall be reinforced with #10 by 6 inches by 6 inches welded wire fabric.

## PART 3 - EXECUTION

### 3.01 Coordination of Traffic

Hazardous areas shall be barricaded to protect pedestrian and vehicular traffic.

Work shall be scheduled so that access is maintained to driveways and entrances through the project area to the extent possible. Where a driveway or entrance must be closed for a period, the property owner or occupant shall be notified in advance of the closing.

### 3.02 Removal of Existing Sidewalk, Curb and Gutter, and Pavement

Where an existing sidewalk, curb and gutter, and/or pavement are to be removed and replaced, the existing structure shall be removed in accordance with Section 024113.13 – Pavement Removal.

### 3.03 Preparation

The base shall be excavated, filled, and shaped, as required, to construct pavement of the required thickness at the proposed grades and alignment. The base shall be compacted according to Section 014516.02 – Density and Aggregate Testing. Soft and yielding soils shall be excavated and replaced with suitable soils.

Where existing curb and gutter has been removed and prior to constructing new curb and gutter, the Contractor shall install 2 dowels,  $\frac{1}{2}$ -inch in diameter, into existing curb and gutter at each end. Cost of dowels are included in the payment for curb and gutter.

Concrete may be placed by slipforming, unless indicated otherwise.

Where forms are used, the forms shall extend the full depth of the concrete. Forms shall be of sufficient strength and staked to prevent springing or yielding after placement of concrete. Flexible forms capable of making a smooth arc shall be used for curved sections. Face forms for the exposed face of curb are not required.

Where steel reinforcement is used, it shall be spliced and held in place in a manner approved by the Engineer. Splices shall be overlapped by 10 inches.

### 3.04 Required Grades

A. Sidewalks shall be constructed with a maximum transverse slope of 2 percent. Transverse slopes shall be at least 1 percent, unless longitudinal drainage is provided. The longitudinal slope of sidewalk shall not exceed the general grade established for the adjacent street or highway. Where adjacent street or highway general grades are less than 5 percent, the longitudinal slope of sidewalk may exceed the general road grade to a maximum of 5 percent.

### 3.05 ADA Requirements

- A. Sidewalks and sidewalk ramps shall meet ADA requirements and shall follow the Michigan Department of Transportation Standard Road Plan R-28-series.
- B. ADA sidewalk ramps shall include polymer, cast in, detectable warning surfaces, red in color. ADA ramps shall be constructed per Michigan Department of Transportation and ADA specifications.
- C. Concrete ramp thickness shall be 6 inches within the first 5 feet behind the back of curb and 4 inches thick beyond the first 5 feet, with a minimum of 4 inches of Michigan Department of Transportation Class II granular material base compacted in place.

### 3.06 Placement of Concrete

Concrete shall not be placed until the forms (or grade, if the concrete will be slipformed) have been inspected by the Engineer. The Contractor shall notify the Engineer a minimum of 24 hours prior to scheduling a concrete pour.

The base shall be moistened just prior to placement of the concrete.

Concrete shall have a temperature between 45 degrees Fahrenheit and 90 degrees Fahrenheit at the time of placement.

Concrete shall be deposited to the proper depth and spaded or vibrated to ensure proper consolidation. Concrete shall be placed and finished in a continuous operation.

Any material required to fill low spots shall be obtained from the mixture used in the work. Exposed surfaces of the concrete slab shall be finished smooth and even by means of a moistened wood float. Sidewalk and pavement slabs shall be lightly brushed perpendicular to the normal direction of traffic. Water shall not be added to the concrete surface as an aid to finishing. The top edges of the slab and all transverse joints shall be rounded with a finishing tool having a radius of ¼-inch. Surfaces shall not vary more than 3/8-inch from the alignment and typical cross section.

Joints shall be constructed in accordance with the Michigan Department of Transportation Standard Road Plan R-29 and R-30 Series.

Expansion joint filler shall extend the full depth of the concrete, with the top of the filler material just below the finished concrete surface.

Exposed concrete surfaces shall be cured using white membrane curing compound, applied uniformly at a rate of 200 square yards per gallon. Curing compound shall be applied regardless of temperature or humidity conditions.

### 3.07 Protection

Concrete shall not be placed if the air temperature is not at least 25 degrees Fahrenheit and rising, or more than 90 degrees Fahrenheit. Concrete shall be protected from damage caused by freezing or rain.

The Contractor shall provide protection for existing surfaces (building faces, light poles etc.) from splattering of concrete. Any damage to building faces, light poles, etc. from concrete splatter shall be repaired or replaced at the Contractor's expense.

The Contractor shall provide sufficient barricading and security to protect fresh concrete from accidental damage or vandalism. Damaged concrete shall be removed to a joint and replaced at the Contractor's expense.

### 3.08 Cleanup

After the concrete has attained sufficient strength, the forms shall be removed.

Where adjacent areas are turf, the area next to the pavement shall be backfilled with sound earth and topsoil, and graded so the surface is about 1-inch below the pavement or as necessary to provide proper drainage.

END OF SECTION 321300



SECTION 329200  
TURF ESTABLISHMENT

PART 1 - GENERAL

1.01 Work Included

This work includes soil preparation, seeding, fertilizing, and mulching on those areas designated for turf establishment.

1.02 References

A. Michigan Department of Transportation Qualified Products List

1.03 Related Work

A. Section 312500 – Soil Erosion and Sedimentation Control

1.04 Performance Requirements for Guaranteed Growth and Smooth Ground Surface

The Contractor is responsible to provide turf, substantially free of bare spots and free of weeds. The ground in turf areas shall be smooth, graded to provide positive drainage, and graded to provide a smooth transition to adjacent areas. The Engineer will determine when the requirements of guaranteed growth and smooth ground surface have been met.

Materials, requirements, and methods described in this specification are provided to establish minimum levels. Where the Contractor believes that other materials or methods are appropriate for the specific site conditions or better suited to the Contractor's schedule, the Contractor shall submit details of the alternative materials and/or methods to the Engineer for approval.

The Contractor shall provide re-seeding, watering, and herbicides, as necessary, to achieve the desired results.

There will be no adjustment in project cost for re-seeding, watering, application of herbicides, or using alternative methods of turf establishment.

1.05 Areas Designated for Turf Establishment

All areas disturbed by the Contractor's activities or as a result of the project, which are not to be restored with a pavement or aggregate surface, are to be restored with turf, unless specifically directed otherwise.

Turf shall be established on borrow areas and areas where excess soil is stockpiled.

When shown on the drawings or directed by the Engineer, the Contractor shall establish turf in other areas.

## PART 2 - PRODUCTS

### 2.01 Materials

#### A. Topsoil

Topsoil shall be a humus-bearing, natural mineral soil of loam, sandy loam, silty loam, or clay loam classification. Topsoil shall neither be excessively acidic or alkaline.

Topsoil shall be screened and free of stones, roots, debris, and other foreign matter. Topsoil which is stripped from the project area shall be removed, transported, and stockpiled in a manner which prevents it from becoming mixed with sub-soils.

#### B. Fertilizer

Fertilizers shall be standard, commercial packaged or bulk products in granular or liquid form. Each container of packaged fertilizer shall be marked by the manufacturer with the following information: manufacturer name; lot number; date; analysis of contents, including the minimum percentages of total nitrogen, available phosphoric acid, and soluble potash; and the net weight. Bulk fertilizer shall be accompanied with an invoice indicating the manufacturer name; lot number; date; analysis of contents, including the minimum percentages of total nitrogen, available phosphoric acid, and soluble potash; and the net weight or volume.

Fertilizer for seeding and sodding shall be comprised of both a water insoluble component and a water soluble component. The water insoluble nitrogen must be from ureaformaldehydes and/or coarse grade isobutylidene diurea.

Fertilizer shall provide 33 pounds of actual water insoluble nitrogen per acre. The water soluble component of the fertilizer shall provide 65 pounds of actual nitrogen, phosphorus, and potassium nutrient per acre, in equal proportions. The water soluble component of the fertilizer shall include urea, diammonium phosphate, and potassium chloride.

#### C. Mulch

##### 1. Loose Mulch

Mulch shall be straw or marsh hay, in an air-dried condition. Mulch material must be clean, undamaged, and rot-free. It must be substantially free of weed seed and other objectionable foreign matter.

##### 2. Turf Mulch Blankets

Mulch blankets shall be manufactured by a company currently listed on the Michigan Department of Transportation's Qualified Products List.

Mulch blankets shall have a net covering on both sides of the blanket and shall be manufactured from either excelsior or straw. Excelsior blankets shall be manufactured from a uniform layer of interlocking excelsior fibers cut from sound, green timber, with an average dry weight of 12 ounces per square yard. Straw blankets shall be made of a uniform layer of clean wheat straw, free of weeds and weed seed, with the straw and

net covering securely stitched together to form a uniform mat having an average dry weight of 8 ounces per square yard.

3. Mulch Anchoring

Mulching anchoring shall be manufactured by a company currently listed on the Michigan Department of Transportation's Qualified Products List.

Latex-based anchoring shall have a composition, by weight, of 48 percent styrene, 50 percent butadiene, and 2 percent additive, 42 percent to 46 percent solids, and a pH of 8.5 to 10.

Recycled newsprint mulch shall be comprised of specifically prepared, biodegradable, shredded newspaper particles consisting of recycled newsprint fibers. The recycled newsprint must contain a wetting agent, defoaming agent, and nontoxic dyestuff that will impart a bright green or blue color. The dyestuff must adhere tightly to the fiber. Recycled newsprint shall meet the following minimum requirements:

Moisture content (total weight)	12 percent maximum
Shredded high-grade newsprint (oven dry)	96 percent minimum
Tackifier, by weight	1½ percent to 3 percent
Water holding capacity (water per 3½ ounces of fiber)	32 ounces minimum

Wood fiber shall be specially prepared, biodegradable, air-dried virgin wood fibers manufactured from 100 percent whole wood chips. The wood fiber must be manufactured with a tackifier. Recycled materials are not acceptable. The fibers must be dyed with a green or blue biodegradable dye to aid in visual metering during construction. The process and materials must not contain growth or germination inhibiting materials. The wood fiber must conform to the following specifications:

Moisture content (total weight)	12 percent maximum
Organic wood fiber (oven dry)	95 percent minimum
Tackifier, by weight	3 percent to 5 percent
Water holding capacity (water per 3½ ounces of fiber)	35 ounces minimum

Guar gum tackifiers shall contain a minimum of 95 percent guar gum by weight. The remaining components shall be dispersing and crosslinking additives.

Other tackifiers may include water soluble natural vegetable gums, or guar gums blended with gelling and hardening agents, or a water soluble blend of hydrophilic polymers, viscosifiers, sticking aids, and other gums.

4. Mulch Netting

Netting shall have a mesh size not larger than 1½ inches by 2 inches and not smaller than ½-inch by ½-inch. The netting shall be fabricated from a plastic formulated from or

treated with a chemical which will promote the breakdown of the net within the first growing season after its placement. The net shall have sufficient strength to hold the mulch in place and still deteriorate rapidly upon exposure to sunlight. Steel staples or pins shall not be used for anchoring of netting.

**D. Sod**

Sod shall be a densely rooted blend of at least 2 bluegrass varieties with 15 percent to 30 percent creeping red fescue content, reasonably free from weeds and grown on soil that is the same or similar to the topsoil at the project site. Sod shall be selected which will adapt well to the topsoil and ambient conditions at the project site and considering future maintenance.

Before sod is cut, the grass shall be mowed to a maximum height of 4 inches above the ground. The sod must be cut at least ¾-inch thick to retain the dense root system of the grass and to allow handling without undue tearing or breaking. When sod is cut in strips, it must be cut in small, uniform units approximately 1½ feet by 6 feet, or in such widths and lengths that can be handled without tearing or breaking. Sod may be cut, transported, and laid in large rolls.

**E. Weed Control**

Herbicides must be approved for use by the Michigan Department of Agriculture and the U.S. Environmental Protection Agency.

**2.02 Seeding Mixtures**

Seed shall be furnished in durable bags, each with a tag indicating the seed supplier, lot number, date, mixture proportions, purity, germination, and net weight.

Seed mixtures shall meet the requirements of one or more of the following mixtures, or other mixtures that are approved in advance by the Engineer. Where the Contractor believes that another mixture is appropriate for areas within the limit of the project, the Contractor shall request that the Engineer review and approve the substituted mixture(s). Requests for substitutions shall include the name of the seed supplier, the mixture proportions, the purity, and the germination.

Species	Purity, Minimum (percent)	Germination (percent)	Seed Mixture						
			Mixture Proportions (percent by weight)						
			TDS	THV	TUF	TGM	THM	CR	TSM
Kentucky Blue Grass	98	85	5	15	10	10	30		
Perennial Ryegrass	96	85	25	30	20	20	20		50
Hard Fescue	97	85	25		20	30			
Creeping Red Fescue	97	85	45	45	40	40	50		
Fults Salt Grass	98	85		10	10				
Cereal Rye	85	85						100	
Spring Oats	85	85							50

### PART 3 - EXECUTION

#### 3.01 Preparation for Turf Establishment

##### A. Topsoil Stripping

Prior to performing any excavation, filling, grading, or other earthwork, the Contractor shall strip and stockpile topsoil for later use on the project. Excess topsoil shall not be removed from the project site unless specifically provided elsewhere in the contract documents.

##### B. Finish Grading

The areas that are to be seeded shall be properly graded, sloped, and shaped with an allowance for the thickness of the topsoil layer. The earth bed upon which topsoil will be placed shall be friable to a depth of at least 4 inches. Earth beds not in a friable condition shall be harrowed with a disk, spring tooth drag, or similar equipment.

##### C. Placement and Preparation of Topsoil

Topsoil shall be spread on the prepared areas to a depth of 3 inches (in place, after rolling or compaction), unless otherwise shown on the plans or proposal. After spreading, any large clods or lumps shall be broken and all stones larger than 1-inch diameter, rocks, roots, litter, and other foreign debris shall be raked up and disposed of by the Contractor. After spreading and raking, the topsoil surface shall be in a friable condition and the surface shall be reasonably close to the proposed grades and cross section.

The topsoil surface shall be shaped to provide proper drainage. Where proposed grades are not shown on the plans, the topsoil surface shall be graded to provide a smooth transition between the new construction and the existing, adjacent ground.

Excess topsoil shall be stockpiled in a location acceptable to the Owner and neatly trimmed to present a neat appearance.

#### 3.02 Turf Establishment

##### A. Permanent Seeding and Fertilizing

Disturbed areas shall be seeded upon completion of earthwork and grading operations. Disturbed areas shall be stabilized with temporary seeding if permanent seeding cannot be completed.

Seed mixtures for permanent seeding shall be appropriate for the soil type and location, as indicated in the following table. The Contractor may propose and submit alternative mixtures to the Engineer for review and approval. It is the Contractor's responsibility to provide turf areas which are substantially free of bare spots and generally weed-free.

Mixture Designation	Soil Type	Location
TDS	Dry Sandy to Sand Loam	Rural or Urban
THV	Heavy	Rural
TUF	All Types	City Streets

<b>Mixture Designation</b>	<b>Soil Type</b>	<b>Location</b>
TGM	Medium to Heavy	All
THM	Loamy to Heavy	Residential / Commercial

Fertilizer and seed shall be applied uniformly on areas prepared for seeding. Seed shall be applied at a rate of 220 pounds per acre. Seed and fertilizer may be applied by drilling, broadcasting, or hydraulically. Seed and fertilizer shall be applied before applying mulch. Seed and fertilizer shall be lightly raked or rolled into the prepared topsoil surface.

Neither broadcast seeding nor hydraulic seeding shall be performed during windy weather.

There shall be provisions for mixing or agitating the seed – fertilizer mixture used for hydraulic seeding to keep it evenly distributed in suspension. Mixtures shall be applied within an hour of mixing the seed with water; unused portions shall be discarded.

**B. Sodding**

Areas to be sodded shall be prepared by grading the area to the desired elevations and contours, less the depth of the topsoil surface and thickness of the sod. Three inches of screened topsoil shall be provided. The topsoil shall be conditioned by harrowing prior to laying the sod. In sloped areas, the harrowing shall be perpendicular to the slope.

The earth bed shall be thoroughly watered just before laying the sod. Sod shall be laid within 24 hours after cutting and shall be properly protected until it is placed. Sod that has been allowed to dry out will not be accepted. Sod shall not be placed on frozen soil, nor shall sod be frozen.

Sod strips shall be placed parallel with the flow of water on slopes and in ditches. The short ends of strips shall be staggered. Strips shall be placed with tight joints. Sod shall be laid starting at the base of the slope and progress upward. The edges of sodded areas shall transition by turning the edges of the sod into the ground and covering the edge with earth (or aggregate if adjacent to a road or pavement) and compacting the covering so that runoff is directed onto the sod. Sod placed adjacent to paved surfaces shall be firmly butted against and level with them.

Sod shall be firmly compacted by tamping it immediately after its placement to provide a surface even, smooth, and free of bumps and depressions. The Contractor shall thoroughly water sod following its placement, and periodically until it has become established.

**C. Temporary Seeding**

Temporary seeding shall be completed when the permanent seeding cannot be completed because of seasonal conditions. Temporary seeding shall be applied at a rate of 100 pounds per acre, and shall be of the following designation.

Mixture Designation	Soil Type	Location
CR	All Types	Temporary, less than 6 months
TSM	All Types	Temporary, more than 6 months

Before completion of the contract, the Contractor shall complete permanent seeding of all areas which are temporary seeded.

D. Dormant Seeding

Dormant seeding should be used only when necessary to complete a project when seasonal conditions are not conducive to permanent seeding. Dormant seeding shall not be completed on frozen ground. Dormant seeding shall be completed, as required, for permanent seeding.

The Contractor is responsible to establish turf which is substantially free of bare spots and generally free of weeds.

3.03 Mulching

A. Mulch Placement

Immediately after the seed has been set into the topsoil surface by light raking or rolling, the Contractor shall spread mulch and anchor it as appropriate. Mulching shall not be performed during windy conditions.

Loose mulch shall be placed thick enough to shade the ground, conserve moisture, and resist erosion, but open enough to allow sunlight to penetrate and air to circulate.

The Contractor shall maintain mulched areas and repair any areas where damage from erosion, wind, traffic, fire, or other causes occur.

Mulch shall be applied at a uniform rate of 2 tons per acre, except that a rate of 3 tons per acre is required with dormant seeding.

B. Mulch Anchoring

Mulch anchoring (tackifiers) shall be sprayed immediately after the mulch is placed. Spraying shall not be performed when wind might prevent the proper placement of the adhesive. The Contractor shall provide protection measures, as necessary, to protect traffic, signs, structures, and other objects from being marked or disfigured by tackifier materials.

Latex based adhesive shall be mixed at a rate of at least 15 gallons of adhesive with a minimum of 250 pounds of recycled newsprint and 375 gallons of water.

Recycled newsprint shall be mixed at a minimum rate of 750 pounds of newsprint with 1,500 gallons of water.

Wood fiber shall be mixed at a minimum rate of 750 pounds of wood fiber with 1,500 gallons of water.

Guar gum shall be mixed at a minimum rate of 100 pounds of dry adhesive and a minimum of 250 pounds of recycled newsprint and 1,300 gallons of water.

Other tackifiers shall be mixed at a minimum rate of 100 pounds of dry adhesive with a minimum of 250 pounds of recycled newsprint with 1,300 gallons of water.

C. Mulching Netting

When netting is used to secure mulch, it shall be secured with anchors, staples, or pins. The net shall be spread over the mulch so that a worker can walk between adjacent widths of the net. The edges of adjacent widths of net shall be pulled together and held in place with net anchors. Net anchors shall be spaced not more than 30 inches apart along the edges, joints, and centerline. The net shall not be installed in direct contact with the ground. If the Contractor elects to use mulch netting or blankets, the Contractor will be required to remove the netting fabric once the turf is established.

D. Mulch Blankets

Mulch blankets shall be installed within one day of seeding. The side edges of blankets shall be overlapped by 2 inches. Blanket ends shall be shingle lapped 6 inches. Non-metallic staples or pegs shall be placed along all joint edges and along blanket centerlines at a maximum spacing of 2 feet. Blankets in waterways shall be shingle lapped 12 inches on the downslope edge. If the Contractor elects to use mulch netting or blankets, the Contractor will be required to remove the netting fabric once the turf is established.

High velocity blankets shall be installed on slopes of 1:2, or steeper, on ditch bottoms, on ditch side slopes (to an elevation 1 foot above the ditch bottom), and where specifically shown on the drawings or directed by the Engineer.

3.04 Weed Control

Weed control shall be provided by the Contractor, as necessary, to develop turf areas which are relatively free of weeds. Herbicides shall be applied in accordance with federal, state, and local regulations. Herbicides shall be applied in accordance with manufacturer's instructions. Herbicides shall be applied by commercial applicators, licensed in the State of Michigan and certified by the Michigan Department of Agriculture in the appropriate category(ies).

Target weeds shall be sprayed in the newly seeded turf when the new turf grass is sufficiently established to withstand the application of herbicide. Herbicide application shall be repeated if the first application failed to control target weeds.

The Contractor shall take appropriate measures to preserve and protect adjacent property from damages resulting from the application of herbicides. Herbicides shall not be applied when wind may carry it to adjacent areas.

END OF SECTION 329200



SECTION 329300  
LANDSCAPING

PART 1 - GENERAL

1.01 Work Included

This work includes excavating planting areas for trees and shrubs, disposing of excess soils, furnishing and planting trees and shrubs of the size and type shown on the plans, backfilling the planting holes with prepared soil, watering and cultivating, and such other work necessary to complete the landscaping as described herein.

This work includes a guarantee of one complete growing season for all planted materials. Where planted materials fail to become established after one complete season, they shall be replaced by the Contractor.

1.02 References

Where materials or methods of construction are listed as being in conformance with a standard specification, it shall refer to the latest edition of the standard specification or any interim revision." before list of 1.02.

A. ANSI Z60.1 – Nursery Stock

PART 2 - PRODUCTS

2.01 Materials

A. Nursery Stock

1. Requirements – General

Nursery stock shall be from nurseries located in Zones 4, 5, or 6 of the USDA Hardiness Zone Map.

All stock shall comply with state and federal laws, with respect to inspection for plant diseases and insect infestation, and the Contractor shall maintain the file with the department with all certificates of such inspection.

Any stock which does not conform to these specifications will be rejected and shall be immediately removed by the Contractor.

All nursery stock shall be true to type and name, in accordance with the current edition of *Standardized Plant Names* published by the American Joint Committee on Horticultural Nomenclature. Stock shall be clearly labeled as to species and variety, giving both the common name and scientific names of the plant. The label or tag shall be securely attached to the plant. When age is specified, the label shall also provide such information. The plant shall be of first-class quality, with well-developed branch systems and vigorous,

healthy root systems. All stock shall be well-formed and the trunks of trees shall be uniform and straight. They shall be free from insects, disease, and defects. Thin, weak plants will not be accepted. All stock shall be nursery grown and shall qualify under ANSI Z60.1, except that the size of ball shall not be less than that shown on the plans. The stock shall come directly from the nursery row. Cold storage plants will not be accepted unless authorized. Substitution shall not be made except with the written permission of the Engineer, and then only when sufficient evidence is shown that the stock called for cannot be secured. Container grown plants shall be used, as called for on the plans or as approved by the Engineer. Such plant material shall meet current ANSI Z60.1.

Inspection of nursery stock will be made at the nursery, by the Engineer, whenever such inspection is deemed advisable. Approval on such inspection shall not be construed as an acceptance of it. Acceptance for planting will not be made until the stock has been delivered and inspected at the planting project site. Inspection will include examination of the root systems of plants. Plants may be examined by removing soil from the root systems of balled or container-grown plants, or digging in the nursery row. Sufficient plant root systems will be inspected for each species and separate plant source to determine the extent and condition of plant root systems. Payment will not be made for plants rendered unsuitable for planting because of the root system inspection. The Contractor shall give the Engineer at least 24 hours' notice before making any delivery of stock, and each shipment shall be accompanied by an invoice showing sizes, species, and varieties included.

Deciduous shade trees shall be straight and symmetrical, with a crown having a persistent main leader. The amount of crown shall be in good overall proportion to the total height of the tree.

Where a clump is specified, it shall have a minimum of two stems originating from a common base at the ground line.

## B. Natural Materials

### 1. Mulching Materials

**Shredded Bark:** This material shall consist of tree bark which has been stripped and shredded from saw logs by means of a de-barking machine. The material shall be sufficiently fine and free from extraneous material so that it will readily pass through a conventional mulch blower.

### 2. Prepared Soil

Topsoil shall consist of the dark brown or black loam, clay loam, silt loam, or sandy loam surface of a fertile, friable, humus soil, or mineral origin.

Peat moss shall consist of finely-shredded sphagnum or fibrous peat moss of an approved commercial grade, free from woody substance.

The fertilizer for mixing with peat moss and topsoil shall be a ready-mixed granular material containing equal amounts, by weight, of phosphorus and potassium.

Prepared soil shall consist of a uniform mixture of topsoil, peat moss, and fertilizer. The prepared soil shall be proportioned such that a cubic yard of the prepared soil will contain  $\frac{3}{4}$ -cubic yard of topsoil,  $\frac{1}{4}$ -cubic yard of peat moss, and sufficient chemical fertilizer to provide 1 pound each of available phosphorus and potassium (5 pounds of 0-20-20, 10 pounds of 0-10-10, etc).

Prepared soil shall be produced by thoroughly mixing the component materials prior to final placement.

#### C. Accessories

##### 1. Wrapping and Balling Materials

Twine for use in tree wrapping shall be composed of a minimum of two-ply jute material. Balling material shall be untreated burlap or other material which will readily decompose. Synthetic materials, such as nylon or plastic, will not be permitted for wrapping or balling.

##### 2. Weed Suppressing Permeable Fabric

Fabric used shall be permeable to air and water. Material shall be black polypropylene with polyester blend. Fabric thickness shall be at least 25 mils.

##### 3. Plastic Planting Bed Edging

Plastic bed edging shall be black polyvinyl chloride, with an average wall thickness of  $\frac{1}{10}$ -inch. Edging height shall be 6 inches. The edging shall be secured in the ground with stakes every 5 feet or per manufacturer recommendations.

##### 4. Tree Stakes

Tree stakes shall be 2-inch by 2-inch hardwood. All stakes shall be straight and free of large knots.

### PART 3 - EXECUTION

#### 3.01 Preparation

Individual holes shall be centered at the proposed plant locations, dug cylindrical in shape with perpendicular sides and flat bottoms. Unless otherwise specified, the minimum diameters and depths of planting holes shall be large enough to permit placing a minimum of 8 inches of prepared soil below, and 12 inches laterally, beyond the ends of bare roots of root balls. Where special conditions of soil or plant requirements so dictate, planting hole sizes shall be subject to reasonable variation.

If site preparation precedes planting by more than two weeks, the planting holes shall be immediately backfilled with prepared soil.

All plant material shall be clearly labeled as to species and variety. At time of planting, the label or tag shall be securely attached to each plant and shall show the scientific name of the plant. Unless otherwise shown on the plans, all plants shall be balled and burlapped or container grown.

Nursery stock shall be prepared for shipment, in accordance with the requirements of the current ANSI Z60.1, and shall be enclosed or covered during transportation to prevent drying.

In preparation for spring planting, all balling operations shall be completed prior to "bud break". All stock shall be dug and packed with care immediately prior to shipment. Plants shall be dug and transported so as to provide and retain a firm ball of earth. The roots shall be carefully protected with wet straw, moss or other material. The root balls shall be adequately protected from rain or sudden changes in the weather. Trees or plants will not be accepted if the balls of earth are loosened or broken.

Plants furnished in containers shall have grown in the container for at least one growing season. Plants other than ground covers, over-established in the container as evidenced by "pot bound" root ends, will not be accepted.

Immediately following delivery and inspection at the job, all plants with exposed roots shall be "heeled in" in moist soil. All "heeled in" plants shall be protected and their roots kept moist until planted. The "healing in" grounds shall be a well-protected, shaded area or a well-ventilated enclosure.

The roots of all planting stock shall be kept moist and adequately protected at all times.

The trunks and branches of all trees shall be carefully protected from injury of any kind during all operations. Any trees that are injured may be rejected.

Planting Beds: Before planting beds are covered with weed control fabric, the beds shall be edged and free of all turf, weeds, dirt clumps, etc. The bed edging lines shall consist of smooth curves, free of kinks, as shown on the plans.

### 3.02 Planting

Just prior to planting, the earth in the bottom of the holes shall be loosened to a depth of 2 inches, and the earth in the sides shall be loosened to the extent necessary to break the glaze caused by digging.

For plants located on slopes, an earth saucer or berm shall be constructed half way around each plant on the down-slope side. The saucer or berm shall have an inside diameter equal to that of the planting hole, and a maximum height of 6 inches. Soil shall not spill down-slope more than 18 inches.

Plants shall be set plumb. Their depth, after setting, shall be the same as the depth in their original location. The prepared soil shall be carefully puddled and thoroughly firmed at intervals during backfilling, under and around the ball. Care should be exercised to prevent damaging the root

ball during the tamping operation. When the plant hole has been backfilled and compacted to one-half depth, the burlap and lacing shall be removed from the upper half of the ball. The backfilling of the hole with prepared soil should then continue to an elevation which, after compaction, is flush with the ground line.

When plants are furnished in containers, the containers shall be removed at the time of planting. Handling methods, which result in a broken or excessively loosened root and soil ball mass, will be sufficient reason for rejection of the plant.

A maximum of root growth shall be preserved and no root pruning will be permitted. Plants shall be set plumb and at a depth equal to the depth in their original location. The exposed roots shall be held firmly in the proper position with the roots spread out. The prepared soil shall be puddled around the roots and thoroughly firmed at intervals during the process of backfilling. Sufficient water shall be used to ensure thorough saturation of the prepared soil placed in the plant hole.

All new and existing trees shall be provided with a 4-foot diameter spade cut mowing ring. Each mowing ring shall be covered with 1 layer of weed suppressing permeable fabric and then 3 inches of shredded bark mulch.

### 3.03 Placement of Bed Edging and Weed Control Fabric

Placing both the bed edging and the weed suppressing permeable fabric shall be performed as recommended by the manufacturer. The weed control fabric shall cover 100 percent of exposed earth within the bed lines. All fabric edges shall be "tucked in" and covered by 3 inches of mulch or 4 inches of stone. Edging is not required around individual tree mowing rings.

Annual beds shall be excavated to a depth of 12 inches and filled with 12-inch screened topsoil base and be mulched with Hoffman CoCoa Shell mulch or comparable light mulch. Material weed suppressing permeable fabric shall not be recommended for annual bed areas.

### 3.04 Pruning, Watering, Cultivating

All pruning shall be done by workmen experienced in this type of work. Pruning shall be completed prior to planting.

The branches shall be pruned to balance the loss of roots in such manner as to retain the natural form of the plant type. Usually one-third to one-half of the branches shall be removed, but the proportion shall in all cases be subject to the approval of the Engineer. The height ratio of crown to trunk, after pruning, shall be approximately one-third crown to two-thirds trunk. The primary leader shall not normally be cut back. Branches to be removed shall be cut off flush with the trunk or main branch.

Immediately upon completion of the planting work, the Contractor shall clean up the area of surplus materials.

The Contractor shall be responsible to water plants, as necessary, throughout the period of establishment. The intervals between waterings shall be determined by the Contractor, based on their experience and climatic conditions.

At the time of final watering, wrapping material, identification tags, and inspection tags shall be removed and disposed of off the project.

### 3.05 Period of Establishment

A period of establishment, commencing at the completion of the initial planting and extending through the following complete growing seasons, will be required for all plants. A growing season is defined as the months of June, July, and August.

All plants shall be in a thriving growing condition at the start of the establishment period.

The Engineer will inspect the plants at the end of the first complete growing season to determine any unacceptable plants. Replacement plants shall be planted, as specified in this specification, prior to May 10 of the following spring planting season. This will fulfill the one-year warrantee on the original plantings and no additional warrantee is required for the replacement plants.

END OF SECTION 329300

SECTION 330500  
ADJUSTING STRUCTURES

PART 1 - GENERAL

1.01 Work Included

This work provides for the vertical adjustment of existing manholes, catch basins, drainage inlets, valve boxes, curb stops, and monument boxes to fit the proposed finish surface. This work includes the temporary lowering of manholes and drainage structures.

1.02 References

Where materials or methods of construction are listed as being in conformance with a standard specification, it shall refer to the latest edition of the standard specification or any interim revision." before list of 1.02.

- A. ASTM A48 – Standard Specification for Gray Iron Castings
- B. ASTM C55 – Standard Specification for Concrete Building Brick
- C. ASTM C443 – Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
- D. ASTM C478 – Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
- E. Michigan Department of Transportation 2020 Standard Specifications for Construction

1.03 Related Work

- A. Section 014516.02 – Density and Aggregate Testing

1.04 Traffic Protection

Vehicular and pedestrian traffic shall be protected from excavations left around structures, structures which have been raised above the level of the adjacent pavement or ground surface, or other hazards by one of the following methods:

- A. Placing and maintaining appropriate barricade(s) at each hazard.
- B. Placing a temporary ramp (HMA on pavement areas, soil or aggregate in non-pavement areas) to provide a smooth transition over the structure.

1.05 Local Standards

All work shall conform to the standards and requirements of the agency(ies) having jurisdiction over the utilities (owning the structures to be adjusted) and the streets or roads (where the

utilities are located). Some of the materials or methods described in these specifications may not comply with local standards.

## PART 2 - PRODUCTS

### 2.01 Materials

#### A. Precast Concrete Grade Rings

Precast grade rings shall be constructed in accordance with ASTM C478. Grade rings shall be of a thickness to provide for adjustment to the required grade.

#### B. Precast Manhole Sections

Precast manhole sections shall be constructed in accordance with ASTM C478. The diameter, height, thickness, and dimensions shall be as necessary to fit the existing structure and provide for its adjustment to the required elevation.

#### C. Masonry

Masonry shall be solid concrete bricks or blocks. Bricks shall meet ASTM C55, Grade S-II. Blocks shall be curved, with the inside and outside radii parallel, and of an appropriate diameter for the manhole or drainage structure. Block dimensions shall be chosen to provide the required transition to the existing structure and provide the required adjustment to the final elevation.

#### D. Castings

Castings for manholes, drainage structures, valve boxes, and monument boxes shall be constructed of gray iron, conforming to ASTM A48, Class 35B. All surfaces of the castings shall be coated with asphaltic paint. The coating shall be smooth, tough, and tenacious when cold, and must not be tacky or brittle.

Lids and frames shall be machined so the lid seats firmly into the frame without rocking.

### 2.02 Mixtures

#### A. Mortar

Mortar shall be a mixture of 1 part cement and 3½ parts granular material (MDOT 2NS). A sufficient quantity of water shall be added to attain the consistency necessary for the work.

## PART 3 - EXECUTION

### 3.01 Adjusting Manholes, Catch Basins, and Drainage Inlets

Structures within paved areas shall be adjusted to the final elevation just prior to placement of the final course of HMA (if located within an area of HMA surface) or prior to placement of the concrete (if located within the curb, sidewalk, or driveway).

Pavement, aggregate, and/or earth around the structure shall be excavated and removed sufficiently for completing the work.



The existing casting of manholes, catch basins, and drainage structures which are to be adjusted shall be carefully removed and protected by the Contractor. Any unsound masonry or concrete in the walls of the manholes, catch basins, and drainage structures shall be removed. If the elevation of the structure's casting is to be lowered, the wall of the existing structure shall be lowered sufficiently so that when re-installed, the casting will be at the proper elevation.

All materials and debris resulting from the demolition and removal of unsound material shall be kept from falling into the sewer pipes, removed from inside of the manholes or structures, and disposed of properly by the Contractor.

Where casting elevations are to be raised or where structure walls need to be rebuilt to replace unsound material, the structure walls shall be built to the required elevation with an allowance for the height of the casting. The walls may be constructed with concrete masonry or precast concrete grade rings or manhole sections.

Following adjustment of the structure, the excavated area shall be filled with aggregate or HMA and compacted according to Section 014516.02 – Density and Aggregate Testing, or concrete to their respective original levels, or to the elevation of the bottom of the final pavement course.

Following placement of the final pavement course, no part of the casting shall extend above the finished surface; the surface of the pavement shall not be greater than 0.02 feet above the top of the casting.

A. Concrete Masonry

Concrete masonry shall be constructed when temperatures are above freezing, including a cure time of at least 24 hours. The first row of blocks shall be laid on a full bed of mortar on a sound, level course of existing masonry or the concrete base. Blocks shall be laid in level courses with ½-inch joints, except where otherwise approved by the Engineer. Joints shall be finished so that the exposed surface is true and smooth. A ½-inch plaster coat shall be provided over the exterior of the block surface. The blocks shall be wetted and joints raked before applying the plaster coat.

B. Precast Concrete Grade Rings and Manhole Sections

Joints for sanitary sewer manholes shall be rubber O-ring type, meeting the requirements of ASTM C443. Joints for storm manholes, catch basins, and inlets shall be bituminous mastic.

C. Metal Ring Adjuster

Where approved for adjustment of castings, a metal ring of appropriate dimensions may be inserted in the existing frame. The metal ring shall be secured to the existing frame.

3.02 Adjust Valve Boxes and Curb Stops

Valve boxes shall be adjusted to the final elevation following the completion of paving operations, other than the final paving course. Valve boxes shall be adjusted just prior to placement of the final course.

Pavement, aggregate, and/or earth around the valve box shall be excavated and removed sufficiently for completing the work.

Existing valve boxes shall be adjusted by sliding or twisting the upper section of the valve box to the required elevation. The valve box shall be securely supported so that the final installation is both plumb and at the required elevation. The excavated area shall be filled with earth, aggregate, or HMA, all compacted according to Section 014516.02 – Density and Aggregate Testing and to their original levels.

Following placement of the final HMA course, no part of the box shall extend above the finished pavement; the surface of the pavement shall not be greater than 0.02 feet above the top of the box.

### 3.03 Adjust Monument Boxes

Existing monument boxes shall be removed prior to beginning construction. Prior to their removal, the Contractor shall notify the Engineer so that the existing survey point can be witnessed and location recorded for future re-establishment. The Contractor shall carefully remove the casting and store it in a safe place for re-use. If the existing casting is damaged prior to the Contractor's removal, the Contractor shall notify the Engineer at the time the damage is discovered.

Following paving operations, the Contractor shall core the pavement at the location for the monument box. The core hole shall have a diameter not greater than 1-inch larger than the diameter of the box. The box shall be grouted in place with a non-shrink grout mixture. No part of the box shall extend above the finished pavement; the surface of the pavement shall not be greater than 0.02 feet above the top of the box. The box shall be located so that the center of the box is not greater than 0.05 feet from the witnessed corner location.

END OF SECTION 330500

SECTION 33 11 00  
WATER MAIN

PART 1 - GENERAL

1.01 Work Included

The Contractor shall install water main and appurtenances in accordance with this specification. This work includes excavation, pipelaying, backfilling, and testing.

The Contractor shall protect existing utilities during construction, whether the existing utilities are shown on the plans or not. Utilities damaged by construction shall be repaired in a manner satisfactory to the Engineer and at the Contractor's expense. The Contractor shall call MISS DIG (800-482-7171) for staking and locating the existing utilities.

The water department will assist the Contractor in locating existing water service leads and mains.

The Contractor shall contact the water department to schedule work that may interfere with existing water service.

The Contractor shall develop a construction sequencing plan and submit to the Engineer and Owner for approval. The construction sequence shall minimize interruption of service.

1.02 References

Where materials or methods of construction are listed as being in conformance with a standard specification, it shall refer to the latest edition of the standard specification or any interim revision.

- A. ANSI A21.4/AWWA C104 – American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
- B. ANSI A21.5/AWWA C105 – American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
- C. ANSI A21.11/AWWA C111 – American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- D. ANSI A21.50/AWWA C150 – American National Standard for Thickness Design for Ductile-Iron Pipe
- E. ANSI A21.51/AWWA C151 – American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water
- F. ANSI A21.53/AWWA C153 – American National Standard for Ductile-Iron Compact Fittings for Water Service
- G. AWWA C110 – Ductile-Iron and Gray-Iron Fittings

- H. AWWA C115 – Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
- I. AWWA C500 – Metal-Seated Gate Valves for Water Supply Service
- J. AWWA C502 – Dry-Barrel Fire Hydrants
- K. AWWA C504 – Rubber-Seated Butterfly Valves
- L. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service
- M. AWWA C512 – Air Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service
- N. AWWA C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
- O. AWWA C600 – Installation of Ductile Iron Water Mains and Their Appurtenances
- P. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
- Q. AWWA C651 – Disinfecting Water Mains
- R. AWWA C800 – Underground Service Line Valves & Fittings
- S. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm), for Water Transmission and Distribution
- T. AWWA C904 – Crosslinked Polyethylene (PEX) Pressure Tubing, 1/2 In. (13 mm) Through 3 in. (76 mm) for Water Service
- U. AWWA C906 – Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm), for Waterworks
- V. AWWA C908 – Standard for PVC Self-Tapping Saddle Tees for Use on PVC Pipe
- W. AWWA C909 – Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 In. (100 mm) and Larger
- X. ASTM B88 – Standard Specification for Seamless Copper Water Tube
- Y. ASTM B251 – Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube
- Z. ASTM C443 – Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
- AA. ASTM C478 – Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
- BB. ASTM D1248 – Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
- CC. ASTM D2657 – Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings

- DD. ASTM D3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
- EE. ASTM D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
- FF. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
- GG. ASTM F714 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
- HH. ASTM F876 – Standard Specification for Crosslinked Polyethylene (PEX) Tubing
- II. ASTM F2080 – Standard Specification for Cold-Expansion Fittings with Metal Compression Sleeves for Crosslinked Polyethylene (PEX) Pipe and SDR9 Polyethylene of Raised Temperature (PE-RT) Pipe
- JJ. ASTM F2657 – Standard Test Method for Outdoor Weathering Exposure of Crosslinked Polyethylene (PEX) Tubing
- KK. ISO 9002 – Model for Quality Assurance in Production, Installation and Servicing
- LL. CSA B137.5 - Crosslinked Polyethylene Tubing Systems for Pressure Applications
- MM. DIPRA – Polyethylene Encasement Installation Guide
- NN. DIPRA – Thrust Restraint Design for Ductile Iron Pipe
- OO. NSF/ANSI Standard 14 – Plastics Piping System Components and Related Materials
- PP. NSF/ANSI Standard 61 – Drinking Water System Components-Health Affects
- QQ. Plastic Pipe Institute TR-3/2021/HDB/HDS/PDB/SDB/MRS/CRS Policies

### 1.03 Related Work

- A. Section 012500 – Materials and Equipment
- B. Section 014516.02 – Density and Aggregate Testing
- C. Section 017123.16 – Construction Staking by Contractor
- D. Section 017450 – Cleanup and Restoration
- E. Section 024113.13 – Pavement Removal
- F. Section 311001 – Clearing and Removal of Miscellaneous Structures
- G. Section 312500 – Soil Erosion and Sedimentation Control
- H. Section 321123 – Aggregate Base
- I. Section 321216 – HMA Paving
- J. Section 321300 – Concrete Curb and Gutter, Sidewalk, and Miscellaneous Pavement

K. Section 329200 – Turf Establishment

1.04 Submittals

Submit shop drawings or manufacturer's data to the Engineer for review and approval prior to ordering for the following:

- A. Hydrants
- B. Valves
- C. Pipe, including fittings and joints
- D. Restraints
- E. Curb stops, corporation taps, and curb stop boxes
- F. Tracer wire and splice connections
- G. Casing pipe
- H. Manholes, manhole adjusting rings, and castings
- I. Directional Bore

1. Work Plan

Prior to beginning work, the Contractor shall submit to the Engineer a work plan detailing the procedure and schedule to be used to execute the project. The work plan should include a description of all equipment to be used, a schedule of work activity, a safety plan (including MSDS of any potentially hazardous substances to be used), an environmental protection plan, and contingency plans for possible problems. The work plan should be comprehensive, realistic, and based on actual working conditions for this particular project. The work plan should document the thoughtful planning required to successfully complete the project.

2. Equipment

Submit specifications on directional drilling equipment to be used to ensure that the equipment will be adequate to complete the project. Equipment shall include, but not be limited to: drilling rig, mud system, mud motors (if applicable), downhole tools, guidance system, and rig safety systems. Calibration records for guidance equipment shall be included. Specifications for any drilling fluid additives that the Contractor intends to use or might use shall be submitted.

1.05 Quality Assurance and Quality Control

A. Leakage

The completed pipeline shall be subjected to a hydrostatic pressure test in accordance with Section 3.19.

**B. Bacteriological**

Following disinfection, a bacteriological test shall be completed in accordance with Section 3.19.

**1.06 Local Standards**

The Owner's standards for materials are shown on the plans. Where there is a conflict between the Owner's standards and the specifications, the Owner's standards prevail.

**1.07 Directional Bore Contractor's Qualifications and Experience**

All directional boring operations shall be done by a qualified directional boring Contractor, with at least five years of experience involving work of a similar nature to the work required of this project.

Notify the Owner and Engineer a minimum of three days in advance of the start of work.

All work shall be performed in the presence of the Owner or Engineer.

**PART 2 - PRODUCTS**

**2.01 Materials**

**A. Pipe**

**1. Ductile Iron Pipe (Thickness Class)**

Ductile iron pipe shall meet ANSI A21.51/AWWA C151. Pipe shall be cement lined and shall meet ANSI A21.4/AWWA C104. Pipe wall thickness shall conform to ANSI A21.50/AWWA C150 and shall be of the following thicknesses, unless specifically noted otherwise on the plans or in the proposal:

<b>Pipe Diameter (inches)</b>	<b>Pipe Class (psi)</b>
4	50
6	50
8	50
10	52
12	52
14	54
16	54
18	54
20	54
24	54

The pipe manufacturer and class shall be marked on each length of pipe.

Joints for buried pipe shall be either mechanical type or push-on type, in accordance with ANSI A21.11/AWWA C111. Working pressure shall be 350 psi. Provide electrical conductivity at each joint.

Joints for piping in structures shall be flanged.

Joints for directionally bored pipe shall be snap lock gasket style manufactured by Griffen, or as approved by the Engineer.

B. Fittings

Fittings shall be mechanical joint or push-on type, either cast iron or ductile iron as follows: Cast iron fittings shall meet the requirements of AWWA C110 and shall be rated for 350 psi working pressure. Ductile iron fitting shall meet the ANSI A21.53/AWWA C153 and shall be Class 350. Fittings shall be cement lined in accordance with ANSI A21.4/AWWA C104. Rubber gasket joints shall meet ANSI A21.11/AWWA C111. Electrical conductivity shall be provided at each joint.

C. Gate Valves

Gate valves shall meet the Owner's standards for manufacturer, style, and opening direction.

Gate valves shall be iron body, non-rising stem, resilient wedge type meeting the requirements of AWWA C509. Gate valves shall be designed for direct bury application.

Resilient seated valves shall meet the requirements of AWWA C509, thick wall valves shall meet AWWA C515.

D. Hydrants

Hydrants shall meet or exceed AWWA C502. Unless otherwise noted, hydrants shall have two 2½-inch hose nozzles and one 4-inch pumper nozzle, National Standard Threads, with all nozzles located 18 inches above ground level.

Nozzle caps shall be securely chained to the barrel. Hydrants shall be of the breakable flange type, such that neither barrel nor stem are damaged upon impact and that no water is lost. Hydrants shall be designed so that the direction of the nozzles can be changed by rotating the above-ground section.

Hydrant color shall be approved by Owner.

Hydrants shall be provided with a drain, which is plugged at the time of delivery. Hydrants are to be of the "dry top" design to prevent freezing.

If removal of the seat valve requires a special wrench, one shall be provided. The wrench shall operate the valve stem at the point of removal of the above-ground section.

Operating nut size, shape, opening direction and model shall be in accordance with the Owner's standards.



E. Copper Pipe

Copper pipe shall be constructed of Type K, soft temper copper tubing for underground use, in accordance with ASTM B88 and B251. The manufacturer and pipe type shall be marked on the outside of the pipe. The weight per foot of copper tubing shall meet or exceed that specified by ASTM B251, Table II.

F. Crosslinked Polyethylene (PEX) Water Service Pipe

PEX pressure tubing shall be made from material having a standard PEX material designation code of PEX 1306, or higher, according to ASTM F876 and intended for use as underground potable water, reclaimed water, and wastewater service lines that conform to a standard dimension ratio of SDR 9. Tubing may incorporate an optional polymeric outer layer.

Pipe shall be certified to AWWA C904 by approved testing agency. In addition, pipe shall be certified to standards ASTM F876, CSA B137.5, NSF 14, and NSF 61, by approved testing agencies, with a standard materials designation code of 3306.

Pipe shall demonstrate ability to satisfy the performance requirements of section F.7 of PPI TR-3 for PE materials in order to apply a 0.63 design factor resulting in a temperature/pressure rating of 200 psi at 73.4 degrees Fahrenheit (1380 kPa @ 23°C).

Pipe shall be rated for 160 psi at 73.4 degrees Fahrenheit (1103 kPa @ 23°C) and 100 psi at 180 degrees Fahrenheit (690 kPa @ 82°C) per PPI TR-4.

Pipe shall have a co-extruded UV Shield made from UV-resistant high-density polyethylene. Pipe shall have minimum recommended UV exposure time of one (1) year when tested in accordance with ASTM F2657, or as per manufacturer's recommendations.

Pipe shall be compatible with cold-expansion compression-sleeve fittings certified to ASTM F2080 for installations as cold as -40 degrees Fahrenheit (-40°C).

Pipe shall be approved for use with AWWA C800 fittings when using manufacturer's recommended insert.

Pipe shall be approved by manufacturer for use with manual plastic pipe squeeze-off tools for temporary stoppage of flow.

G. Stops and Fittings

Corporation stops, curb stops, and fittings shall be fabricated of brass and shall be lead free.

For PVC pipe, any taps 2 inches or less shall be Style 202B saddle with stainless steel bands, as manufactured by Ford Brass or approved equal.

H. Service Boxes

Water services boxes shall be of a style conforming to the Owner's standard. Boxes shall be adjustable, a minimum of 6 inches above and below finish grade.

I. Valve Boxes

Valve boxes shall be made of good quality cast iron and shall be of the sectional type. The lower section shall be a minimum of 5 inches in diameter, enlarged at the base to fit around the bonnet of the valve. The upper section shall be arranged to slide or screw down over the adjoining lower section and shall be full diameter throughout. Valve boxes shall be provided with cast iron lids or covers. Lids or covers shall be marked "WATER". The over-all length of valve boxes shall be sufficient to permit the top to be set flush with the final ground surface grade. Valve boxes shall be as manufactured by Traverse City Iron Works, Clow Corporation, or equal.

J. Materials for Gate Wells

The manhole base, sections, and reducer shall be manufactured in accordance with ASTM C478, with rubber gasket conforming to ASTM C443. The manhole sections shall be provided with an 8-inch pre-cast base slab. Integrally cast wall and slab sections are required.

Precast riser rings shall be manufactured in accordance with Michigan Department of Transportation Standard Plan R-1-Series.

Adjusting rings shall be manufactured in accordance with ASTM C478.

Manhole steps shall be copolymer polypropylene plastic steps with a steel reinforcement bar, with a minimum diameter of ½-inch, a minimum width of 10 inches center to center of wall anchor, and complete with anti-skid side plates conforming to ASTM D4101. Steps shall be manufactured with the manhole wall and spaced at a maximum of 16 inches on center. Gray iron castings shall be heavy duty classification and shall conform to ASTM A48 Class 35B coated with asphalt coating.

Manhole frames and covers shall be EJ No. 104014 with 1040 AGS cover and covers shall be stamped "WATER" with 2-inch raised letters, or approved equal.

K. Tracer Wire

Tracer wire shall be designed and manufactured for the purpose of detecting buried utilities. Tracer wire shall be 12 AWG (minimum) copper wire coated with a 30 mil (minimum) polyethylene jacket. The Contractor shall use larger wire, when necessary, for installation without damage during bored installations.

L. Polyethylene Encasement

Polyethylene encasement shall be in tube and sheet form, fabricated from either linear low-density polyethylene film having a thickness of at least 8 mils or high-density, cross-laminated polyethylene film with a thickness of at least 4 mils.

### PART 3 - EXECUTION

#### 3.01 Alignment and Grade

The water mains shall be constructed at the alignment and grades indicated in the plans and

specifications, except where changes are directed or approved by the Engineer. Fittings, valves, hydrants, and service connections shall be installed at the locations indicated on the drawings or in the specifications, except where field conditions warrant changes which are directed and approved by the Engineer.

Valves and hydrants shall be installed plumb. Valve operating stems shall be installed in a manner to allow for their proper operation.

### 3.02 Investigation

Prior to excavation, the Contractor shall call MISS DIG and shall contact utility agencies which are not part of the MISS DIG system to make arrangements for identifying the location of existing utilities in the project area. Where potential conflicts are suggested by the plans and/or the utilities' locations, the Contractor shall excavate and expose the existing utilities at least 100 feet in advance of pipelaying operations. Where the existing utilities may conflict with the proposed alignment and construction, the Contractor shall make such appropriate modifications to the alignment and grade, as necessary, to prevent a conflict. Changes to the alignment and grade shall be as directed and approved by the Engineer. Changes to the alignment and grade shall be completed by the Contractor at no additional cost to the project.

### 3.03 Excavation

The Contractor shall excavate all materials to the depths necessary to construct the water main as shown on the plans. Excavation shall include the removal of rock, dirt, abandoned pipelines, old foundations, stumps and roots, and similar materials encountered. Excavation of whatever material encountered shall be included in the contract unit prices for water main installation and will not be paid for separately.

Excavation shall be in accordance with Section 312301 – Excavating, Filling, and Grading.

### 3.04 Pipe Handling

Pipe shall be handled in such a manner as to prevent the ends from splitting, damages to the protective coatings, and other undesirable conditions. Pipe shall not be dropped, skidded, or rolled into other pipe. Repairs to damaged pipe must be approved by the Engineer.

### 3.05 Pipe Cutting

Pipe cutting shall be done in a neat and workmanlike manner, without damage to the pipe or lining, and as to leave a smooth end at right angles to the axis of the pipe. Cutting shall be done by an approved mechanical saw or cutter. Hydraulic squeeze cutters are not acceptable.

### 3.06 Pipelaying

Pipe located inside structures shall be rigidly supported.

Pipe laid underground shall be uniformly supported through its entire length on a 4-inch cushion of sand. A depression shall be carved out of the sand cushion to accommodate the pipe bells.

Pipe shall be inspected for defects, debris, or dirt while suspended in a sling prior to lowering it into the trench. Defective pipe shall be removed from the project site immediately. Lumps, blisters, and excess coal tar coating shall be removed from inside the bell and outside the spigot. These areas shall be wire-brushed and wiped clean with a dry oil-free rag. No debris, tools, clothing, or other materials shall be allowed in the pipe.

Pipe shall be laid in a dry trench, with bell ends facing in the direction of laying. After placing a length of pipe in the trench, and after installing the gasket and applying the gasket lubricant, the spigot end shall be centered in the bell, and the pipe pushed home and brought to the correct line and grade. The pipe shall be secured in place by tamping sand around it. Precautions shall be taken to prevent soil from entering the joint space.

A watertight plug shall be inserted in the open end(s) of the pipe to prevent water, soil, animals, or other foreign matter from entering the pipe during the construction phase.

When it is necessary to deflect pipe from a straight line, either horizontally or vertically, the deflection shall not exceed the following values:

<b>Nominal Pipe Size (inches)</b>	<b>PVC &amp; PVCO "Push on" Joint Maximum Deflection (inches/18-foot length)</b>	<b>Ductile Iron "Push on" Joint Maximum Deflection (inches/18-foot length)</b>	<b>Ductile Iron Mechanical Joint Maximum Deflection (inches/18-foot length)</b>
4	4	19	27
6	4	19	27
8	4	19	20
10	4	19	20
12	4	19	20
14	0	11	13
16	0	11	13
18	0	11	13
20	0	11	11
24	0	11	9

### 3.07 Jointing

#### A. Fittings

Mechanical and "push on" joints shall be installed in accordance with the joint manufacturer's recommendations. Copies of such recommendations shall be furnished to the Engineer prior to the start of construction.

Flange faces of flanged joints shall be thoroughly cleaned with a wire brush and the pipe carefully aligned. The gasket shall then be inserted between the flanges and the bolts and

nuts installed. Tightening of the bolts shall be done evenly around the flange so as to uniformly distribute the stress carried by the bolts.

B. Butt Fusion

Joints for pipe shall be by thermal butt fusion per ASTM D2657. All joints shall be performed in accordance with the procedures recommended by the manufacturer.

3.08 Tracer Wire

A tracer wire shall be laid along the crown of any plastic pipes. The wire shall be attached to the top of the pipe in such a manner that it will not become displaced during construction and backfilling. Tracer wire shall be continuous (without splices) over each separate run. If wire is damaged or broken during installation, a new wire shall be installed by the Contractor. The wire shall be terminated in valve wells or boxes as approved by the Engineer.

3.09 Backfilling

Backfilling shall be in accordance with Section 312302 – Excavating, Filling, and Grading.

3.10 Separation and Cover

Where the proposed water main crosses under an existing utility, the proposed water main shall be deflected above or below the existing utility in accordance with the following:

- A. Maintain a minimum depth of cover over top of proposed water main as shown on the drawings.
- B. Maintain at least 18 inches of vertical separation and 10 feet of horizontal separation between the outside of the proposed water main and the outside of a sewer, drain pipe, or catch basin lead.
- C. Maintain at least 1 foot of vertical separation between the outside of the proposed water main and the outside of an existing utility other than a sewer, drain or catch basin lead.
- D. When crossing an existing sewer, drain pipe, or catch basin lead, construct the proposed water main so that its joints are equidistant from the utility being crossed.

3.11 Hydrants and Valves

A. General

Hydrants and valves shall be located as shown on the plans or as otherwise directed by the Engineer. Failure by the Contractor to locate said hydrants or valves, as called for, may result in Contractor correcting the error at their own expense.

B. Setting Hydrants

Hydrant bowls shall be set on stone or concrete slab and braced to resist thrust. Hydrants shall be set perfectly plumb. Hydrant valves shall be located 2 feet from the hydrant, unless otherwise directed by the plans or Engineer.

Excavations for the construction of hydrants and hydrant leads shall be backfilled with sand and compacted. That portion of the excavation outside the 1:1 influence of an existing or proposed roadway, sidewalk, driveway, parking lot, structure, or railroad, and at least 12 inches above the pipe, may be backfilled with suitable excavated material, and compacted.

Hydrants shall be supplied with the correct bury height needed at each location. If the water main is deeper than the minimum bury depth for constructability purposes and the hydrant lead pipe elevation cannot be adjusted, the hydrant bury height will need to be increased or the hydrant shall have an extension installed accordingly.

#### C. Removal of Hydrants

Where shown on the plans or otherwise directed by the Engineer, the Contractor shall remove existing hydrants. The ground shall be excavated to the depth of the hydrant lead. The water main shall be "shut down" by the water department. The Contractor shall remove the hydrant, lead, valve, and box. The fitting on the main shall be plugged and blocked. The excavation shall be backfilled with sand and compacted. The hydrant, valve, and box shall be delivered to the water department service yard. That portion of the excavation that is outside the 1:1 influence of the existing or proposed roadway, and at least 12 inches above the pipe, may be backfilled with suitable excavated material and compacted.

#### D. Setting Valves

Valves shall be examined by the Contractor prior to lowering in the trench. All nuts and bolts shall be checked to assure tightness.

Valves shall be installed with the valve closed, supported on two 2-inch by 6-inch by 18-inch hardwood blocks and vertically plumb. The valve box shall be set plumb and its axis shall be in line with the stem. Valve boxes shall have the ability for future adjustments of up to 6 inches, above or below grade.

#### E. Cutting-in Valves

Where shown on the plans or directed by the Engineer, the Contractor shall install a new valve on an existing line. The existing main shall be uncovered by the Contractor. A section of the existing main shall then be cut out. The length will vary depending on the valve and sleeve dimensions. A suitable mechanical joint cutting-in sleeve shall be slid over one end of the pipe, and a gate valve installed over the other end. After the gate valve is in the "home" position, the sleeve shall be slid into the gate valve. The gaskets shall be positioned and the mechanical joints shall be tightened to the manufacturer's specifications. The valve shall be plumb. Provide support under the valve by placing two 2-inch by 6-inch by 18-inch hardwood boards. The completed installation shall be visually inspected for leaks before the pipe is covered. The valve box shall be installed over gate valve and adjusted to the proposed grade. The excavation shall be backfilled with sand and compacted. That part of the excavation that is not within the 1:1 influence of an existing or proposed roadway or railway, and at least 6 inches above the water main, may be backfilled with suitable excavated material and compacted.

F. Reconnection of Existing Hydrants

Where the plans call for reconnection of an existing hydrant to a new main, the Contractor shall excavate, as necessary, to locate the existing hydrant lead. The lead shall be cut in a location, directed by the Engineer. The Contractor shall then connect the hydrant to the new main by the use of sleeves, tees, elbows, 6-inch ductile iron pipe, and a 6-inch gate valve and box, as conditions require. The excavation shall be backfilled with sand and compacted. That portion of the excavation outside of the 1:1 influence of an existing or proposed roadway or railroad may be backfilled using suitable excavated material and compacted.

3.12 Polyethylene Encasement

All ductile iron fittings and hydrants below grade shall be wrapped with polyethylene encasement. Installation shall be as set forth in ANSI A21.5/AWWA C105 and DIPRA's "Polyethylene Encasement" brochure.

3.13 Thrust Restraint

All tees, plugs, bends, hydrants, offsets, and similar fittings shall be mechanically restrained or braced to undisturbed ground by use of concrete thrust blocks.

Concrete for use as thrust blocks shall have a 28-day compressive strength of not less than 3,000 psi. The thrust block shall be placed so that the pipe, valve, hydrant, or fitting joints are accessible for repair. Details of placement of thrust blocks are shown on the plans. Vertical bends will require blocking and strapping as shown on the plans.

Restrained joints shall be designed in accordance with DIPRA *Thrust Restraint Design for Ductile Iron Pipe*. The following restraint joint systems are approved for ductile iron pipe, when observed by the Engineer.

Pipe Size	Restrained Joint Type
12 inch or less	Field Lok, Fast Grip
16 inches or larger	FlexRing, TR Flex

Restrained joints for PVC and PVCO pipe shall be as follows:

- A. MEGALUG by EBAA Iron, Series 19MJ00 or approved equal for mechanical joint restraints.
- B. MEGALUG by EBAA Iron, Series 1900 or approved equal for push joint/bell restraints.

Restrain all mechanical joints with retainer glands. Restraint all joints within length(s) according to restraint schedule, as determined using EBAA Iron Restraint Length Calculator.

Restrained joints are considered included in work of water main construction and will not be paid for separately.

3.14 Connection of Polyethylene to Fixed Appurtenances for Fittings

All connections where PE water main is transitioned to a different type of piping material or fitting, the pipe shall be anchored in concrete at the connection of the PE to the existing or proposed line or fitting. Concrete for use as anchor blocks shall have a 28-day compressive strength of not less than 3,000 psi. A flanged HDPE fitting shall be butt fused at the location of the transition of differing materials and encased in concrete.

3.15 Water Services

Water services shall be constructed where shown on the plans or where directed by the Engineer.

Water service pipe shall be connected to the water main through a brass corporation stop.

Water service pipe shall be connected to the water main through a service clamp or saddle (except where direct tapping is permitted) and brass corporation stop. The water main shall be under pressure during the tapping process. The pipe shall be drilled and tapped to the appropriate size for the connection being installed. The service clamp or saddle shall provide full support around the circumference of the pipe, and have a bearing area of sufficient width along the length of the pipe so that the pipe will not be distorted when the saddle is tightened. U-bolts will not be permitted.

Ductile iron pipe may be direct tapped in accordance with the following tables. Direct taps shall be drilled and tapped under pressure by use of a tapping machine with a combination drill and tap of the appropriate size for the connection being installed.

<b>Minimum DIP Thickness Class Required for Direct Tapping</b>					
<b>Water Main Diameter (inches)</b>	<b>Tap Size</b>				
	<b>¾"</b>	<b>1"</b>	<b>1¼"</b>	<b>1½"</b>	<b>2"</b>
4	53	55			
6	51	53	55		
8	50	52	53	55	
10	50	51	52	53	
12	50	50	51	52	55
16	50	50	50	50	54
20	50	50	50	50	52
24	50	50	50	50	50

<b>Minimum Pressure Class of DIP Required for Direct Tapping</b>					
<b>Water Main Diameter (inches)</b>	<b>Tap Size</b>				
	<b>¾"</b>	<b>1"</b>	<b>1¼"</b>	<b>1½"</b>	<b>2"</b>
4					
6					



<b>Minimum Pressure Class of DIP Required for Direct Tapping</b>					
<b>Water Main Diameter (inches)</b>	<b>Tap Size</b>				
	<b>¾"</b>	<b>1"</b>	<b>1¼"</b>	<b>1½"</b>	<b>2"</b>
8	350				
10	350				
12	350				
16	250	250	250	300	350
20	250	250	250	250	250
24	250	250	250	250	250

PVC and PVCO pipe shall not be direct tapped. Services 2 inches and under shall utilize a service saddle.

The maximum service connection for PVC and PVCO pipe is 2 inches.

After tapping the main and installing the corporation stop, the tap shall be tested by turning the corporation on and off. Any leakage detected visually shall be corrected by the Contractor.

The water service pipe shall be laid such that there is at least 24 inches of slack in the service line at the main. In other words, the first 3 feet of trench adjacent to the main shall have at least 5 feet of service lead pipe laid in it.

All joints of copper pipe shall be flared joints. After the copper pipe is in place and connected to the curb stop, the line shall be visually checked for leaks by closing the curb stop and opening the corporation stop.

The Contractor shall leave the corporation stop in the open position, unless directed otherwise by the Engineer.

The excavation resulting from water service pipe construction or reconnections and within the 1:1 influence of a roadway, driveway, sidewalk, parking lot, railroad, or other structures shall be backfilled by the Contractor with sand and compacted. Excavations not within the 1:1 influence of structures or paved surfaces may be backfilled with suitable native soils and shall be compacted.

Water service pipe shall be buried to the depth shown on the plans for water main depth, unless otherwise directed by the Engineer.

### 3.16 Conflicts with Existing Utilities

Excavation shall be made sufficiently in advance of pipelaying operations so that water main alignment can be adjusted to go above, below, or around existing pipes, structures, cables, or other obstacles that are encountered. Where such minor adjustments are made to the water main alignment, no additional compensation will be due to the Contractor.

Where existing electric cables, telephone cables, gas mains, or services are damaged, repairs shall be at the Contractor's expense. The repairs shall be made by the appropriate utility.

Where sewer leads are damaged, they shall be repaired by the Contractor at no charge to the Owner. Sewer leads shall be repaired with a section of schedule 40 PVC pipe of the size encountered. Pipe of the same material as that encountered can also be used. The damaged pipe shall be cut square and the "connection" area shall be thoroughly cleaned. Rubber gasketed sleeve couplings, suitable for connecting the pipe sizes and materials encountered, shall be furnished and installed by the Contractor for each reconnection or repair joint.

### 3.17 Conflicts with Proposed Utilities

This work consists of relocating a portion of existing water main or water service to avoid a conflict with a proposed utility. This work includes furnishing all labor, equipment, and materials required for excavation, installation, disinfection, and backfilling as shown on the plans and specified within this specification.

### 3.18 Restoration

Areas disturbed by construction activities shall be restored by the Contractor.

### 3.19 Testing and Disinfection

#### A. Hydrostatic Pressure Testing for Water Main

Water main shall be hydrostatically tested immediately after the section to be tested is installed. The Contractor shall provide all labor, equipment, and materials to perform the test, including pumps, gauges, plugs, corporations, water, miscellaneous pipes and fittings, and a means of measuring lost water. The testing equipment shall be approved by the Engineer.

The Contractor shall fill the main through hydrants or corporations. After completion of the tests, corporations made for the purpose of testing shall be plugged. Water shall be added to the line and air expelled to provide a pressure of 150 psig. When the Contractor has verified that all air is expelled and that the test pressure is maintained, the Contractor shall notify the Engineer to witness the test. The Engineer shall be given at least a 24-hour notice. The test duration shall be two hours. Water shall be added during the test period, as required, to maintain the required pressure to the highest point in the system throughout the test period. The amount of water required to maintain the test pressure is the actual leakage.

The actual leakage shall not exceed the allowable leakage as tabulated below:

<b>Pipe Size (inch)</b>	<b>Allowable Leakage per 1,000 feet of Water Main (gallons/2 hours)</b>
6	1.00
8	1.32

<b>Pipe Size (inch)</b>	<b>Allowable Leakage per 1,000 feet of Water Main (gallons/2 hours)</b>
10	1.66
12	1.98
16	2.64
20	3.32
24	3.98

If unsatisfactory results are obtained, the Contractor shall locate and repair the leak and the system shall be retested.

**B. Tracer Wire Continuity**

The Contractor shall demonstrate continuity of the installed tracer wire to the Engineer.

**C. Disinfection**

The Contractor shall flush the water main with potable water until discharge from the main runs clear. The main shall be chlorinated in accordance with AWWA C651. After the chlorination procedure is completed, the water main shall be flushed again until the chlorine content is equal to that of the water being supplied. Sixteen hours or longer after the flushing, the Contractor may begin collecting samples for bacteriological analysis. Samples shall be collected at 24-hour intervals until two consecutive satisfactory results are obtained. Samples shall be collected at the end opposite the chlorine injection, except that in long lines or where contamination is suspected, the Engineer may require other sampling points. Sampling shall be performed under the observation of the Engineer.

Where satisfactory results are not obtained, the main shall be reflashed, re-disinfected, and retested. Heavily chlorinated water shall be disposed of properly.

**3.20 Abandoning Water Mains**

Existing water main shall be abandoned where shown on the drawings or directed by the Engineer.

Water main that is to be abandoned shall be disconnected from the existing main which is to remain in service. A suitable sized plug or cap shall be installed on the existing main to remain in service, together with suitable thrust restraint.

Where directed, the existing water main, together with any fittings and appurtenances, shall be removed in their entirety. The Contractor shall fill the excavation resulting from the excavation and removal of the pipe. Backfill within the 1:1 influence of pavements, roads, driveways, or structures shall be sand and compacted according to Section 014516.02 – Density and Aggregate Testing. Backfill in other areas shall be suitable soil, free of rocks, debris, and frozen material and compacted according to Section 014516.02 – Density and Aggregate Testing.

If the abandoned water main is to remain in place, the open ends of the pipe (or fittings) shall be

bulkheaded. When designated on the plans or by the Engineer, the existing pipe shall also be filled with a lean grout mixture (flowable fill). The Contractor shall provide suitable openings in the pipe to fill the pipe and prevent the trapping of air. Fill shall be placed evenly to avoid displacing pipes or structures. Pipes and conduits within the fill area shall be secured to resist any movement resulting from buoyant forces.

END OF SECTION 331100

SECTION 333100  
SANITARY SEWER

PART 1 - GENERAL

1.01 Work Included

The Contractor shall supply all labor, material, and equipment required for the installation and testing of gravity sanitary sewers and appurtenances in compliance with these general specifications, project specifications, and the contract drawings.

1.02 References

Where materials or methods of construction are listed as being in conformance with a standard specification, it shall refer to the latest edition of the standard specification or any interim revision.

- A. ASTM A48 – Standard Specification for Gray Iron Castings
- B. ASTM C76 – Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
- C. ASTM C443 – Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
- D. ASTM C478 – Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
- E. ASTM C923 – Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
- F. ASTM C1479 – Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations
- G. ASTM D1785 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
- H. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- I. ASTM D2665 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
- J. ASTM D2680 – Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
- K. ASTM D3034 – Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- L. ASTM D4101 – Standard Specification for Polypropylene Injection and Extrusion Materials

- M. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- N. ASTM F1417 – Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air
- O. ASTM F1668 – Standard Guide for Construction Procedures for Buried Plastic Pipe
- P. ANSI A21.4/AWWA C104 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
- Q. ANSI A21.5/AWWA C105 – Polyethylene Encasement for Ductile-Iron Pipe Systems
- R. ANSI A21.10/AWWA C110 – Ductile-Iron and Gray-Iron Fittings
- S. ANSI A21.11/AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- T. ANSI A21.51/AWWA C151 – Ductile-Iron Pipe, Centrifugally Cast
- U. ANSI A21.53/AWWA C153 – Ductile-Iron Compact Fittings
- V. Michigan Department of Transportation 2020 Standard Specifications for Construction

#### 1.03 Related Work

- A. Section 012500 – Materials and Equipment
- B. Section 014516.02 – Density and Aggregate Testing
- C. Section 017123.16 – Construction Staking by Contractor
- D. Section 017450 – Cleanup and Restoration
- E. Section 311001 – Clearing and Removal of Miscellaneous Structures
- F. Section 312500 – Soil Erosion and Sedimentation Control
- G. Section 329200 – Turf Establishment

#### 1.04 Submittals

The Contractor shall submit shop drawings or certificates of compliance to the Owner and Engineer for the following items.

- A. Pipe, fittings, and joint material
- B. Manholes and manhole adjusting rings and castings
- C. Pipe bedding and backfill material

#### 1.05 Quality Assurance and Quality Control

##### A. Grade and Alignment

Grade and alignment shall be maintained using a laser. The Contractor shall verify that the sewer is constructed at the proper alignment by checking grades and offsets at each manhole,

at 50 feet upstream from manholes, and at 100-foot intervals. The Contractor shall report as-constructed measurements to the Engineer.

B. Acceptance Tests

The completed sewer(s) shall be subjected to the following tests, prior to acceptance by the Owner. Acceptance tests shall be completed by the Contractor, in the presence of the Engineer (or Owner's representative).

1. Infiltration Tests

The infiltration test shall be completed in accordance with Section 3.10.A.

2. Air Test

Air testing shall be completed in accordance with section 3.10.B.

3. Deflection Testing

All plastic sewers shall be subjected to a deflection test in accordance with Section 3.10.C.

4. Physical Inspection

The physical inspection shall be completed in accordance with Section 3.10.D.

PART 2 - PRODUCTS

2.01 Materials

All material supplied shall be new and shall be designed and guaranteed to perform the service required.

A. Pipe

Pipe shall be of the material, class and/or thickness indicated on the plans or on the proposal. If no specific materials or classes are provided on the plans or on the proposal, any of the following pipe materials are permissible.

1. PVC Pipe

All PVC pipe shall be ASTM D3034 gasketed sewer pipe with an SDR of 26 or lower and conform to ASTM D2321. PVC pipe conforming to ASTM D1785 Schedule 40 and ASTM D2665 is acceptable for 6-inch service leads.

2. PVC Truss Pipe

Truss pipe shall conform to ASTM D2680. Pipe and fittings shall be homogeneous throughout and free from visible cracks, holes, or other defects. Fittings shall conform to ASTM D2680 Section 7.1 and Tables 5 and 6. Joints shall be made with gasketed bell coupling connections. Elastomeric seals (gaskets) shall meet ASTM F477 requirements.

3. Ductile Iron Pipe

Pipe shall be ductile iron Class 53, manufactured in accordance with the requirements of ANSI A21.51/AWWA C151. Push on joints for the pipe shall be in accordance with ANSI

A21.11/AWWA C111. Pipe shall have cement mortar lining and seal coating in accordance with ANSI A21.4/AWWA C104.

Polyethylene wrap shall be in accordance with ANSI A21.5/AWWA C105 and shall be provided for all pipes except for those in manholes.

Fittings shall be mechanical joint or push-on type, either cast iron or ductile iron as follows: Cast iron fittings shall meet the requirements of AWWA C110 and shall be rated for 350 psi working pressure. Ductile iron fitting shall meet the ANSI A21.53/AWWA C153 and shall be Class 350. Fittings shall be cement lined in accordance with ANSI A21.4/AWWA C104. Rubber gasket joints shall meet ANSI A21.11/AWWA C111. Electrical conductivity shall be provided at each joint.

#### 4. Reinforced Concrete Pipe

Where specified on the drawings, all sanitary sewers 18 inches or larger shall be reinforced concrete pipe conforming to ASTM C76, with joints conforming to ASTM C443. The size and class shall be as shown on the drawings. If the class is not shown on the drawings, Class III pipe shall be used when the cover over the pipe is 16 feet or less; Class IV pipe shall be used when the cover over the pipe is between 16 feet and 23 feet; and Class V pipe shall be used when the cover over the pipe is 23 feet or more.

#### B. Materials for Manholes

The manhole base, sections, and reducer shall be manufactured in accordance with ASTM C478 with rubber gaskets conforming to ASTM C443. The manhole sections shall be provided with an 8-inch pre-cast base slab for depths up to 20 feet and a 12-inch pre-cast base slab for greater depths. Integrally cast wall and slab sections are required. Manhole lifting holes shall not be permitted in the manhole sections. Lifting lugs shall be cast into the manhole for lifting.

Precast risers ring shall be manufactured in accordance with Michigan Department of Transportation Standard Plan R-1-Series.

Adjusting rings shall be manufactured in accordance with ASTM C478.

Manhole connection shall be cored openings with watertight, flexible rubber connectors meeting ASTM C923.

Manhole steps shall be copolymer polypropylene plastic steps with a steel reinforcement bar, with a minimum diameter of ½ inches, a minimum width of 10 inches center to center of wall anchor, and complete with anti-skid side plates conforming to ASTM D4101. Steps shall be manufactured with the manhole wall and spaced at a maximum of 16 inches on center. Gray iron castings shall be heavy duty classification and shall conform to ASTM A48 Class 35B coated with asphalt coating.

Manhole frames and covers shall be EJ No. 1040ZPT Type A solid cover, or Neenah Foundry Company No. R-1916-F, or approved alternate.



Manhole frames shall have anchor base flange holes furnished for bolting the frames to the cone section. Covers shall be equipped with four stainless steel cap screws countersunk flush with the cover. The frame and cover shall be connected to the cone section by use of 4 chromite coated  $\frac{5}{8}$ -inch thread studs with washers and nuts, field cut bolts to proper length. All covers shall be stamped "SANITARY SEWER" with 2-inch raised letters.

C. Drop Connections

Pipe and fittings for drop connections shall be PVC or ductile iron.

2.02 Material Testing

All materials to be incorporated in the construction of gravity sewers and appurtenances shall be subject to inspection and tests, as specified by ASTM or AWWA references. The Owner reserves the right to subject any material supplied for a particular project to an independent testing laboratory. Such tests, if scheduled, shall be paid for by the Owner. The results of such tests shall be the basis of material acceptance.

The Contractor shall supply the Owner with shop drawings, a certificate of compliance, or actual test results stating that the material to be used is in conformance with the specifications prior to using material for construction.

PART 3 - EXECUTION

3.01 General

Sewers shall be constructed in accordance with the following standards, except as modified in this specification:

- A. Concrete Pipe: ASTM C1479
- B. Plastic Pipe: ASTM F1417 and ASTM F1668

3.02 Excavation

Excavation shall be completed in accordance with Section 312301 – Excavating, Filling, and Grading.

3.03 Pipe Alignment

It shall be the Contractor's responsibility to transfer the line and grade to the bottom of the excavation for pipe laying. Lasers shall be used for pipe laying.

It shall be the Contractor's responsibility to protect the original survey control and benchmarks, as set by the Engineer.

### 3.04 Pipe Laying

Each pipe shall be laid on an even, firm bed, so that no uneven strain will come to any part of the pipe. Particular care shall be exercised to prevent the pipes bearing on the sockets. Bell holes for bell and spigot pipe shall be dug at each point as specified before. Each pipe shall be laid in the presence of the inspector. The bell-end of the pipe shall be laid up-grade. Pipe laying shall proceed in the upstream direction, except where otherwise approved by the Engineer.

The interior of the sewer shall be cleaned of all dirt, debris, jointing material, and other material.

All pipe shall be completely pushed to the "home" position.

Pipes laid in tunnel or casing pipe shall be supported on suitable blocks, cut or grouted into position to place the invert of the sewer or drain at the slope, and to the elevations indicated on the contract drawings.

### 3.05 Connections to Existing Sewers

When replacing an existing sewer or manhole or constructing a new manhole over an existing sewer, the original sewer shall be reconnected to the new sewer or manhole. Existing sewer pipe shall be removed, salvaged, and reused to make connection to the new manhole, if possible. If existing pipe is not salvageable, a new sewer pipe shall be installed, as required, and connected to the existing sewer. When a new sewer is connected to an existing sewer, the existing sewer shall be removed to an existing joint, if existing joint is compatible with new sewer. If existing sewer joint is not compatible with new sewer, a watertight coupler shall be installed.

### 3.06 Pipe Joints

In all jointing operations, the trench must be dewatered when joints are made. Bell and spigot or tongue and groove ends of the pipe shall first be wiped clean before actual jointing operations are started.

Joints between consecutive bell and spigot or tongue and groove pipe shall be made with a rubber gasket. The gasket shall be fitted over the tongue or spigot of each pipe, as recommended by the manufacturer, and the pipe entered into the bell or groove and shoved home.

#### A. PVC Joints

All PVC pipe shall be joined with rubber compression gaskets that are factory installed. The joint shall be lubricated and joined so the "home" mark on the pipe is flush with the bell end.

#### B. Joints for Reinforced Concrete Pipe

Both the bell and spigot ends of the pipes to be joined shall be cleaned. The rubber joint shall be lubricated with material furnished by the joint manufacturer. The spigot end of the pipe shall be pushed "home" into the bell end of the receiving pipe.

### 3.07 Connections for Service Pipes

Service connections for house sewers shall be provided in the main sewers, as shown on the contract drawings or as designated in the specifications. The exact location shall be as directed by the Engineer during construction.

Either tee or wye branches are acceptable for service connections, where the main line sanitary sewer is 12 inches or greater. Wye fittings are required on 8-inch and 10-inch sewers. Service leads shall be installed at a sufficient depth to service house basements if the main line sewer is sufficiently deep, but shall be left above the water table at their terminus.

The Contractor shall place a hardwood stake on the property line directly opposite each opening left in the sewer. The hardwood stake shall be 8 feet long and a minimum size of 2 inches by 2 inches. The Contractor shall locate and keep a record, in tabular form, of all manhole and sewer opening locations by measurement to the nearest downstream opening. All manhole locations shall be witnessed by at least two ties to existing topographic features. This record shall be delivered to the Engineer during the progress of the work. When constructing sanitary sewer connections in wet ground, place a 45-degree bend at the property end of the connection and install enough house lead to bring the connection above the natural ground water level.

For service connections where the main line is less than 10 feet deep, the Contractor need not supply a riser connection for the service lead. The service connection shall be left at a depth of 8 feet to 10 feet below the ground at the property line. The Contractor has the option of installing the house lead at an incline or using a riser section for sewers less than 10 feet deep.

When the invert of the sanitary sewer is in excess of 10 feet, a riser section shall be used to raise the service connection to a point approximately 10 feet below the surface of the ground. All service connections shall be installed in accordance with the standard details.

All openings shall be plugged with air tight stoppers.

Service leads on easements or adjacent to property lines shall extend one pipe length from the main line sewer, but not beyond the easement limit.

### 3.08 Manholes

All manholes shall be constructed at the locations shown and in accordance with the contract drawings. Manholes shall be constructed of precast wall sections with a rubber gasket in the joint. The precast top section shall be an eccentric cone. Precast bases shall be installed on the subbase in such a way as to provide a uniform bearing under the manhole. Manholes shall have either a precast integral bottom and channel or a field constructed channel. The steps and castings shall be constructed in accordance with the standard details on the construction drawings.

Holes shall be cored through the manhole for necessary pipe connections. Each pipe opening shall be provided with a resilient connector.

Openings into existing manholes (sewer tap), shall be made by a concrete drilling or coring machine. The opening shall be no larger than necessary for the new sanitary sewer. A watertight resilient connector shall be installed in the cored hole for the tapped sewer connection. The new tap shall be supported at the external side of the manhole with 6A stone or concrete. The end of the tapped pipe shall be flush with the interior surface of the manhole. The existing flow channel shall be adjusted in accordance with the plan details.

Flow channels and/or drop connections shall be constructed as detailed on the construction drawings.

### 3.09 Backfill

Backfill shall meet the requirements of Section 312301 – Excavating, Filling, and Grading.

### 3.10 Acceptance Tests - Sanitary Sewers

The methods of testing shall be approved by the Engineer. The Contractor shall provide the necessary equipment and labor for making the tests, and the cost of testing and repair shall be included in the unit price bid for completed sanitary sewer. The Engineer shall determine when grouting or relaying of faulty pipe is required.

#### A. Infiltration Testing

Sewers 24 inches and larger shall be subjected to an infiltration test. Infiltration into the sanitary sewer shall be measured by use of an infiltration manhole where called for on the plans or by a V-notched sharp crested weir. The weir shall be furnished and installed by the Contractor, as directed by the Engineer. The joint shall be tight and visible leakage in the joints or excess of the specified amount shall be repaired at the Contractor's expense.

There shall be no allowable infiltration for PVC sanitary sewer pipe. The maximum amount of allowable leakage for other sanitary sewer pipe materials shall be limited to 100 gallons per inch diameter, per mile, per 24-hour day. The maximum allowable leakage shall be limited to 1,200 feet test length. The Contractor may elect to test longer sections of pipe, but the maximum allowable leakage shall be calculated based on a 1,200-foot test length. All testing shall be monitored by the Engineer.

#### B. Air Testing

Sewers less than 24 inches in diameter shall be subjected to an air test. The Contractor shall furnish all necessary labor, equipment, and supervision to perform the required air testing. The testing of PVC pipe sewer shall conform to ASTM F1417.

The Contractor shall be required to furnish the Owner with acceptable air test results for each segment of sanitary sewer. All testing shall be monitored by the Engineer.

The procedure for air testing of sewers shall be as follows:

The sewer line shall be tested in increments between manholes. The line shall be cleaned and

plugged at each manhole. Such plugs shall be designed to hold against the test pressure and shall provide an air-tight seal. One of the plugs shall have an orifice through which air can be introduced into the sewer. An air supply line shall be connected to the orifice. The air supply line shall be fitted with suitable control valves and a pressure gauge for continually measuring the air pressure in the sewer. The pressure gauge shall have a minimum diameter of 3½ inches and a range of 0-10 psig. The gauge shall have minimum divisions of 0.10 psig and an accuracy of plus or minus 0.04 psig.

The sewer shall be pressurized to 4 psig, plus sufficient pressure to equal the force exerted by ground water over the pipeline. At least 2 minutes shall be allowed for the air pressure to stabilize between 3.5 and 4 psig. If necessary, air shall be added to the sewer to maintain a pressure of 3.5 psig or greater.

After the stabilization period, the air supply control valve shall be closed so that no more air will enter the sewer. The sewer air pressure shall be noted and timing for the test begun. The test shall not begin if the air pressure is less than 3.5 psig, or such other pressure as is necessary to compensate for ground water level.

The time required for the air pressure to decrease 1 psig during the test shall not be less than the time shown in the following table:

Pipe Diameter (inches)	Minimum Test Time (minutes)	Pipe Length for Minimum Time (feet)	Time for Longer Pipe Length (seconds)
4	3:46	597	0.380 L
6	5:40	398	0.854 L
8	7:34	298	1.520 L
10	9:26	239	2.374 L
12	11:20	199	3.418 L
15	14:10	159	5.342 L
18	17:00	133	7.692 L
21	19:50	114	10.470 L

Length is based on the length of the sewer main only. If laterals or other leads are connected, their lengths are not to be included in the testing length.

If a sewer fails to pass any of the previously described tests, the Contractor shall determine the location of the leaks, repair them, and retest the sewer. The tests shall be repeated until satisfactory results are obtained.

C. Deflection Testing

All sanitary sewers constructed using plastic pipe shall be subjected to a deflection test. The Contractor shall furnish all labor, materials, and equipment necessary to perform deflection testing. The testing shall be completed after the pipeline has been backfilled for a period of at least 30 days. The pipeline shall be tested with a rigid ball or mandrel having at least 7 points, and having a diameter of not less than 95 percent of the average inside diameter of

the pipe being tested. The average diameter for the pipe will be as specified by the ASTM specification for the pipe material, class, and size. Where testing indicates that the pipe deflection exceeds 5 percent of the pipe diameter, the pipe shall be removed and replaced. Pipe that is replaced shall be re-tested at least 30 days following its replacement.

Deflection testing shall be performed in the presence of the Engineer. The Contractor shall provide the Engineer with a least two working days' notice of conducting deflection testing.

D. Physical Inspection

Upon completion of all work, the Contractor shall open all manholes in the presence of the Engineer to demonstrate that the manholes are complete and free of debris.

3.11 Bypass Pumping

Bypassing of the existing sewage shall be provided, as required, to maintain uninterrupted sanitary sewer service. The line shall be plugged at an upstream manhole and the flow shall be pumped to a downstream point or adjacent system. The pump and bypass lines provided shall be of sufficient size to handle the normal and peak flow conditions for the system. Internal combustion engines shall have adequate exhaust silencers to muffle engine noise to an acceptable level for the area where located.

The bypass plan for each segment of pipe shall be submitted to the Owner and Engineer for review and approval prior to the start of the project, along with a list of equipment. All property owners affected by the bypass shall be notified by the Contractor a minimum of 48 hours in advance.

END OF SECTION 333100

SECTION 334400  
STORM SEWERS

PART 1 - GENERAL

1.01 Work Included

This work includes construction of storm sewers, drainage structures, and appurtenances. Drainage structures include catch basins, inlets, manholes, and manhole tees.

1.02 References

Where materials or methods of construction are listed as being in conformance with a standard specification, it shall refer to the latest edition of the standard specification or any interim revision." before list of 1.02.

- A. AASHTO M36 – Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains
- B. AASHTO M170 – Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
- C. AASHTO M294 – Standard Specification for Corrugated Polyethylene Pipe, 300-mm to 1,500-mm (12-in. to 60-in.) Diameter
- D. ASTM A48 – Standard Specification for Gray Iron Castings
- E. ASTM C76 – Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
- F. ASTM C443 – Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
- G. ASTM C478 – Standard Specifications for Circular Precast Reinforced Concrete Manhole Sections
- H. ASTM D1056 – Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber
- I. ASTM D4101 – Standard Specifications for Polypropylene Injection and Extrusion Materials
- J. Michigan Department of Transportation 2020 Standard Specifications for Construction
- K. Michigan Department of Transportation Standard Plans

1.03 Related Work

- A. Section 014516.02 – Density and Aggregate Testing
- B. Section 017123.16 – Construction Staking by Contractor
- C. Section 017450 – Cleanup and Restoration

- D. Section 312301 – Excavating, Filling, and Grading
- E. Section 312500 – Soil Erosion and Sedimentation Control
- F. Section 329200 – Turf Establishment

#### 1.04 Quality Assurance and Quality Control

##### A. Grade and Alignment

Grade and alignment shall be maintained using a laser. The Contractor shall verify that the sewer is constructed at the proper alignment by checking grades and offsets at each manhole, at 50 feet upstream from manholes, and at 100-foot intervals. The Contractor shall report as-constructed measurements to the Engineer.

##### B. Acceptance Tests

The completed sewer(s) shall be subjected to the following tests, prior to acceptance by the Owner. Acceptance tests shall be completed by the Contractor, in the presence of the Engineer (or Owner's representative).

###### 1. Internal Video Inspection

The video inspection shall be completed in accordance with Section 3.07.A.

###### 2. Physical Inspection

The physical inspection shall be completed in accordance with Section 3.07.B.

## PART 2 - PRODUCTS

#### 2.01 Materials

##### A. Pipe

Unless a specific type, class or thickness is called for on the plans or in the proposal, material class shall meet the requirements of Pipe Alternates for Storm Sewer Classes, as described in Section 402 of the Michigan Department of Transportation 2020 Standard Specifications for Construction. Corrugated steel pipe may be used only where shown on the drawings.

###### 1. Reinforced Concrete Pipe

Pipe shall meet ASTM C76. Where no class is shown on the drawings or on the proposal, Class III or better shall be provided.

Joints shall be rubber gaskets in accordance with ASTM C443.

Reinforced concrete pipe to be installed by jacking shall be Class V and shall be provided with full circular reinforcement. Pipe joints shall be butt type.

###### 2. Smooth-Lined Corrugated Plastic Pipe

Where storm sewers from 12-inch to 24-inch diameter are called for on the plans, with at least 3 feet of cover over the pipe, and when a particular kind of sewer pipe is not specified, the Contractor may furnish smooth-lined corrugated plastic pipe (SLCPP).



SLCPP shall be corrugated polyethylene pipe meeting the requirements of AASHTO M294, Type S. Any fittings required shall also meet the requirements of AASHTO M294. Only fittings supplied or recommended by the pipe manufacturer shall be used. When gaskets are used in couplings to provide watertight or silt-tight joints, gaskets shall be a band of expanded rubber meeting the requirements of ASTM D1056 for Type 2 closed cell rubber, or O-rings meeting the requirements of ASTM C443.

3. PVC Pipe

All PVC pipe shall be ASTM D3034 gasketed sewer pipe with a SDR of 26 or lower. PVC pipe conforming to ASTM D1785 Schedule 40 and ASTM D2665 is acceptable for 6-inch service leads.

4. Corrugated Galvanized Steel Pipe

Pipe with circular cross section and reformed pipe with pipe arch shape shall conform to AASHTO M36. The Contractor shall furnish the Owner with two copies of a certification of compliance, with the chemical requirements of the base metal, as specified in AASHTO M36.

Corrugated metal pipe shall be a minimum of 8-gauge or wall thickness of 0.168 inches.

For pipe arch shapes, minimum thickness shall be based on the next larger size if the actual span dimension is not listed.

B. Drainage Structures

Drainage structures shall be precast concrete units meeting the requirements of ASTM C478 with rubber gaskets conforming to ASTM C443. Drainage structures shall be 4 feet in diameter, unless shown otherwise on the plans or in the proposal. Precast concrete grade rings meeting ASTM C478 shall be used to adjust the top of the structure to the final grade. At least 6 inches, but not more than 18 inches, of vertical adjustment shall be provided with grade rings. Manhole lifting holes shall not be permitted in the manhole sections. Lifting lugs shall be cast into the manhole for lifting.

Manhole steps shall be copolymer polypropylene plastic steps with a steel reinforcement bar, with a minimum diameter of ½-inch, a minimum width of 10 inches center to center of wall anchor, and complete with anti-skid side plates conforming to ASTM D4101. Steps shall be manufactured with the manhole wall and spaced at a maximum of 16 inches on center. Gray iron castings shall be heavy duty classification and shall conform to ASTM A48 Class 35B coated with asphalt coating.

C. Castings

Castings shall meet the requirements of the Michigan Department of Transportation 2012 Standard Specifications for Construction, and the Michigan Department of Transportation Standard Plans.

### PART 3 - EXECUTION

#### 3.01 Excavation

Excavation shall be completed in accordance with Section 312301 – Excavating, Filling, and Grading.

#### 3.02 Pipelaying

Sections of sewer pipe shall be carefully laid in the prepared trench, bell ends upgrade, with the spigot end fully entered in the adjacent bell. Each section shall have firm bearing throughout its length and shall be substantially true to the line and grade required. The use of blocks to bring sections to grade will not be permitted.

Circular concrete pipe with lift holes shall be installed with the lift holes on top of the pipe. Holes shall be plugged with suitable concrete plugs before backfilling.

Existing live sewers that are to remain shall be carefully protected during construction of the new sewers. If they are damaged in any way, they shall be immediately repaired or replaced, as directed by the Engineer.

All junctions with house or building leads shall be made in a manner acceptable to the Engineer.

Flexible watertight joints shall be installed in accordance with the manufacturer's recommendations.

Connections to sewers owned by other agencies shall be done in accordance with their requirements.

Connections to existing sewers having a plug or bulkhead shall be made with a watertight joint. The plug or bulkhead shall be removed without damage to the sewer, and the plug material shall be removed from the sewer and properly disposed of.

If there are no openings in the existing pipe or structures at the point of connection, an opening shall be cut in the pipe or the structure sufficiently large enough to permit 3 inches of mortar to be packed around the entering pipe and the mortar pointed up smooth and flush with the inner wall. Pipe passing through pipe or structure walls shall be cut at the end to conform with the shape of the inside of the wall and to be flush therewith. On the outside of the pipe or structure, the entering pipe shall be encased with sufficient mortar to provide bearing under the pipe. Any existing pipe broken or cracked while making the connection shall be replaced at the Contractor's expense.

When replacing an existing sewer, connections to the original sewer or drain that are encountered shall be reconnected to the new sewer.

Sewers and drainage structures shall be reasonably free of accumulation of silt debris and other foreign matter at the time of final acceptance.

### 3.03 Backfill

Backfill shall meet the requirements of Section 312301 – Excavating, Filling, and Grading.

### 3.04 Additional Requirements of Construction for SLCPP Sewers

SLCPP shall be installed in accordance with Section 3.01. and the additional requirements provided here.

Joints in SLCPP shall be wrapped with a 2-foot wide strip of non-woven geotextile filter fabric with a 1-foot lap at the fabric joint.

The installed pipe shall not be deformed such that any diameter is reduced by 5 percent or more. Deformed pipe shall be removed and replaced at the Contractor's expense. The completed pipeline shall be tested for deformation by the Contractor under the Engineer's supervision. The Contractor shall furnish a 9-point mandrel having a diameter equal to at least 95 percent of the original uninstalled inside diameter of the pipe. The mandrel shall meet the Engineer's approval. Mandrel testing shall be performed no less than thirty calendar days after installation.

### 3.05 Additional Requirements for Construction of Corrugated Steel Pipe Sewers

#### A. Repair of Damaged Galvanized Surfaces

The Contractor shall take special care when removing, salvaging, storing, handling, or placing new culverts or culverts that are to be relaid so that they are not dented, scraped, or the galvanized coating is otherwise damaged.

Large diameter or long culverts shall be provided with shop attached lift rings to facilitate handling. Lift holes shall not be cut in corrugated steel pipe.

Saw cut ends of corrugated steel pipe shall be reasonably free from excessive jagged burrs or sharp spurs.

Surfaces on which the spelter coating has been damaged, whether by transporting, handling, or installation, shall be thoroughly cleaned by wire brushing and then painted with two (2) coats of zinc rich paint conforming to federal specification: Paint shall be High Zinc Dust Content, Galvanizing Repair (Ready Mixed Type) MIL-P-21035.

#### B. Laying and Jointing Pipe

All pipe shall be laid true to the lines and grades given. Each length shall have full, firm bearing throughout its length.

Separate sections of corrugated pipe shall be securely joined together with standard corrugated metal bands. The bands may be up to 2 standard thicknesses lighter than the

culvert, but shall not be less than 0.64 inches (16-gauge). Bands for culverts shall not be less than the following widths:

<b>Pipe Diameter</b>	<b>Band Minimum Width</b>
up to & including 18 inches	7 inches
21 inches through 60 inches	12 inches
over 60 inches	24 inches

The corrugations of the band shall match those of the pipes being joined. The band shall be secured with bolts and angles. Couplings may be either one piece or two pieces. Smooth coupling bands, dimpled bands, and helical-rod and lug bands will not be considered acceptable.

### 3.06 Drainage Structures

Precast concrete units shall be placed on a 6-inch sand base, leveled, and thoroughly compacted. Joints shall be sealed with mortar. Joints shall be thoroughly wetted prior to sealing. The joints inside the structure shall be flush with the walls. Joints shall be completely filled with mortar.

Pipe or tile connections to concrete drainage structures shall extend through the structure wall and be cut flush with the inside surface. The opening around the pipe shall be neatly filled with mortar to prevent leakage.

Drainage structure covers shall be new and adjusted to the finish elevation using precast concrete grade rings. Covers shall be of the type called for on the plans. Covers and grade rings shall be set in full mortar beds.

Cover elevations given on the plans are for information only. The final elevation will be determined in the field, based on as-constructed conditions.

Drainage structures shall be maintained reasonably free of accumulations of silt, debris, and other foreign matter at the time of final acceptance.

### 3.07 Acceptance Tests - Storm Sewers

The methods of testing shall be approved by the Engineer. The Contractor shall provide the necessary equipment and labor for making the tests, and the cost of testing and repair shall be included in the unit price bid for completed storm sewer. The Engineer shall determine when grouting or relaying of faulty pipe is required.

#### A. Alignment, Grade, and Connections

Each section of the storm sewer shall be checked for alignment and grade by using a closed circuit television inspection. The report and video shall indicate the measurements from manhole center to manhole center and shall tabulate all connections. The Contractor shall supply the Engineer with a digital recording of the video inspection and a listing of service connections prior to requesting final inspection.

**B. Physical Inspection**

Upon completion of all work, the Contractor shall open all manholes in the presence of the Engineer to demonstrate that the manholes are complete and free of debris.

END OF SECTION 334400