
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

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

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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 re-advertising, 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 re-advertising.

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.

Construction Mechanic– A skilled or unskilled mechanic, laborer, worker, helper, assistant, or apprentice working on a state project but shall not include executive, administrative, professional, office, or custodial employees

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 2013 PA 174, as amended, MCL 460.721.

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., ET, on 9/4/2024. 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, **Construct MVSBB Howell**, File No. **511/24024.CAK** includes, but is not necessarily limited to **SESC controls, removal of asphalt and concrete pavements, curb and gutter removal, excavation and grading, installation of storm sewers and structures, installation of crushed limestone aggregate base, bollards, HMA paving, concrete flatwork, chain link fencing, site lighting, construction of 5,000+/- square foot metal military vehicle garage, spreading topsoil, hydro-seeding and site restoration**. The site is located at **727 Isbell Street, Howell, MI 48843**, as shown on the Drawings.

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 **via Microsoft Teams and in-person**, MI on **8/19/2024** at **1:30 p.m.** ET. A tour of the facility will will not be held on the same day, **immediately following the meeting**. 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.

6. A remote meeting on Microsoft Teams will be held

simultaneously for those not required to attend on site via one of the following options

- (a) To join the TEAMS video conference, please contact kenlow@bria2.com prior to the meeting and the meeting invitation will be forwarded to you.
- (b) To join the Teams meeting **by phone**, please contact kenlow@bria2.com for the Conference ID number. Dial + 1 929-352-1571, 850966605# United States, Pontiac (toll) the day of the meeting and enter the Conference ID number when prompted.

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

7. 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**.

8. 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 Sub agreement under the Contract.

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

10. Contact Person – All requests or inquiries concerning the Bidding Documents, or the Work shall be addressed to **Beckett & Raeder, Inc., Kristofer Enlow, P.E. at kenlow@bria2.com**

11. Award – Subject to any agreed extension of the period for holding Bids, Bids shall remain valid for acceptance by the **Owner** for **ninety (90)** 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 readvertising 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 – Beckett & Raeder, Inc.
WORK – Construct M/VS/BS Howell
FILE No. – 511/24024.CAK

BEFORE BID OPENING:

8/22/2024 – 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).

8/22/2024 – 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 Non-collusion 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
- 5.4 Byrd Anti-Lobbying Certification (Only when Federal Provisions Addendum is included)

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

PROFESSIONAL – Beckett & Raeder, Inc.

WORK – Construct MVSB Howell

FILE No. – 511/24024.CAK

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 – Beckett & Raeder, Inc.

WORK – Construct MVSB Howell

FILE No. – 511/24024.CAK

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.

Geotechnical investigation performed by G2 Consulting Group, dated June 17, 2024.

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):

No list is provided

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.

None are itemized

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.

None are itemized

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.

None are itemized

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.

None are itemized

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.

7.0 PREVAILING WAGE

7.1. The Bidding Documents include either the attached Schedule of prevailing rates of wages and fringe benefits for all classes of Construction Mechanics called for in the Bid and resulting Contract, if any, or the attached current prevailing wage determination issued by the U.S. Department of Labor, as applicable depending on the funding source(s).

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 511/24024.CAK	DEPARTMENT/AGENCY Military and Veterans Affairs	
CONTRACT TIME(S) June 30, 2025 (substantial completion deadline)	PROJECT NAME Construct MVSB Howell	LOCATION 727 Isbell St. Howell, MI 48843
BID OPENING DATE September 4, 2024 at 2:00 pm ET		FOR AN EXAMINATION OF THE SITE CONTACT: Doug Shilling 517-599-6881
SEE SECTION 00100 INSTRUCTIONS TO BIDDERS AND SECTION 00700 GENERAL CONDITIONS PROVIDED WITH THE BIDDING DOCUMENTS. 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.		
FIRM NAME AND COMPLETE ADDRESS		TELEPHONE NUMBER and E-MAIL ADDRESS
<input type="checkbox"/> Qualified Disabled Veteran		SIGMA VENDOR NUMBER <small>(protected information required for processing payments)</small>
BIDDER'S SIGNATURE AND TITLE	DATE	WITNESS' SIGNATURE 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 \$ _____ <small>(use words) (in figures)</small>
Alternate 1: (Add/Subtract) _____ Dollars \$ _____ <small>(use words) (in figures)</small>
Alternate 2: (Add/Subtract) _____ Dollars \$ _____ <small>(use words) (in figures)</small>
Alternate 3: (Add/Subtract) _____ Dollars \$ _____ <small>(use words) (in figures)</small>

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. BUILDERS RISK INSURANCE IS REQUIRED TO BE PROVIDED BY THE CONTRACTOR UNLESS OTHERWISE INDICATED IN THE BID DOCUMENTS.

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

Project Scope of Work:

SESC controls, removal of asphalt and concrete pavements, curb and gutter removal, excavation and grading, installation of storm sewers and structures, installation of crushed limestone aggregate base, bollards, HMA paving, concrete flatwork, chain link fencing, site lighting, construction of 5,000+/- square foot metal military vehicle garage, spreading topsoil, hydro-seeding and site restoration.

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**PROFESSIONAL** – Beckett & Raeder, Inc.

WORK – Construct MVSB Howell

FILE No. – 511/24024.CAK

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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 2013 PA 174, as amended, MCL 460.721 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	SESC Measures	N/A	\$
2	Lump Sum	Demolition and Removals	N/A	\$
3	Lump Sum	Earthwork and Grading	N/A	\$
4	Lump Sum	Crushed Limestone Aggregate Base	N/A	\$
5	Lump Sum	Concrete Work, including bollards	N/A	\$
6	Lump Sum	HMA Paving	N/A	\$
7	Lump Sum	Electrical Site Work	N/A	\$
8	Lump Sum	Natural Gas Site Work	N/A	\$
9	Lump Sum	Fencing and Gates	N/A	\$
10	Lump Sum	Storm Sewers and Structures	N/A	\$
11	Lump Sum	Military Vehicle Garage Building Complete	N/A	\$
12	Lump Sum	All other work and costs not included in Items 1 through 11 above.	N/A	\$
		ALLOWANCE AMOUNT		\$100,000.00
TOTAL (This amount should equal the Base Bid amount on the Bid Summary Form)				\$

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

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

Name of the Bidder _____ 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 _____ 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
1			\$	
2	Linear Foot	Saw Cut Asphalt or Concrete Full Depth	\$	
3	Square Yard	Remove and Dispose Concrete Flatwork	\$	
4	Linear Foot	Remove and Dispose Concrete Curb and Gutter	\$	
5	Square Yard	Remove and Dispose Asphalt Pavement	\$	
6	Square Foot	Bituminous Pavement, Standard Duty, incl. Compacted Aggregate Base per Detail 6 on Drawing Sheet C5.0	\$	
7	Square Foot	Concrete Pavement, Heavy Duty, incl. Compacted Base per Detail 7 on Drawing Sheet C5.0	\$	
8	Linear Foot	Guard Rail, per Detail 10 on Drawing Sheet C6.0	\$	
9	Cubic Yard	Sub-Grade Undercutting	\$	
10	Cubic Yard	MDOT 21AA Crushed Limestone, C.I.P.	\$	
11	Cubic Yard	MDOT Class II Fill, C.I.P.	\$	
12	Linear Foot	Fencing, per Details on Drawing Sheet C5.1	\$	

Name of the Bidder _____

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

FILE No. 511/24024.CAK 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.

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,

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.

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. _____

Email: _____

END OF SECTION 00310

SECTION 00320 NONCOLLUSION AFFIDAVIT

PROFESSIONAL – Beckett & Raeder, Inc.

WORK – Construct MVSB Howell

FILE No. – 511/24024.CAK

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

PROFESSIONAL – Beckett & Raeder, Inc.

WORK – Construct MVSBS Howell

FILE No. – 511/24024.CAK

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 – Beckett & Raeder, Inc.
WORK – Construct MVSBS Howell
FILE No. – 511/24024.CAK

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)

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 – Beckett & Raeder, Inc.

WORK – Construct MVSB Howell

FILE No. – 511/24024.CAK

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 – Beckett & Raeder, Inc.

WORK – Construct MVSBS Howell

FILE No. – 511/24024.CAK

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: _____

SECTION 00430 LIST OF SUBCONTRACTORS

PROFESSIONAL – Beckett & Raeder, Inc.

WORK – Construct MVSBB Howell

FILE No. – 511/24024.CAK

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 – Beckett & Raeder, Inc.

WORK – Construct MVSBS Howell

FILE No. – 511/24024.CAK

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 **PROFESSIONAL**)

ITEM OF MATERIAL OR EQUIPMENT	SPECIFICATION SECTION	CONTRACTOR TO NOMINATE (CIRCLE) ITS CHOSEN NAMED OR SPECIFIED MANUFACTURERS AND SUPPLIERS
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

SECTION 00500 AGREEMENT

FILE No. 511/24024.CAK CONTRACT ORDER No. Y _____

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* To be Completed With the Bidding Documents

** 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.

STATE OF MICHIGAN MODEL

Developed from FORMSPEC™ Michigan Model

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1.2. PROJECT NAME – Construct MVSB Howell

1.3. THE WORK – SESC controls, removal of asphalt and concrete pavements, curb and gutter removal, excavation and grading, installation of storm sewers and structures, installation of crushed limestone aggregate base, bollards, HMA paving, concrete flatwork, chain link fencing, site lighting, construction of 5,000+/- square foot metal military vehicle garage, spreading topsoil, hydro-seeding and site restoration.

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 33 of the Specifications, and Drawings, bearing the title: Construct MVSB Howell dated August 12, 2024.

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: _____

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: _____

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 **Seven Hundred** Dollars and No/Cents (**\$700.00**)

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 **Seven Hundred** Dollars and No/Cents (**\$700.00**)

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 [Beckett & Raeder, Inc.](#) 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

THE CONTRACTOR

BY:

Title: _____ Date

NAME: _____

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

Telephone No.

Witness:

Date:

Address for giving notices

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 File No. _____ Work _____, _____ 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 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

SECTION 00520 ATTACHMENT "A" TO AGREEMENT

PROFESSIONAL – Beckett & Raeder, Inc.
WORK – Construct MVSBS Howell
FILE No. 511/24024.CAK **CONTRACT ORDER No.** Y_____

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) within _____ (___) Days from the date when the Contract Time commences to run, or on or before _____, 20____.
- (b) within _____ (___) Days from the date when the Contract Time commences to run, or on or before _____, 20____.
- (c) within _____ (___) Days from the date when the Contract Time commences to run, or on or before _____, 20____.

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) _____ Dollars and No/Cents (\$ _____); (b) _____ Dollars and No/Cents (\$ _____); and (c) _____ Dollars and No/Cents (\$ _____) 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

FILE No. 511/24024.CAK SURETY COMPANY REFERENCE No. _____

"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 held and 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, in compliance with 1963 PA 213, as amended, MCL 129.201 et seq.

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

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 IS VOID, OTHERWISE TO REMAIN IN FULL FORCE AND EFFECT.

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) releases the Surety of its obligations under this Section 00610 Performance Bond. The Surety 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).

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 must 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 Licensing and Regulatory Affairs, must be listed on the current U.S. Department of the Treasury Circular 570, and, unless otherwise authorized by the Owner in writing, must 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. _____

Email: _____

END OF SECTION 00610

SECTION 00620 PAYMENT BOND

FILE No. 511/24024.CAK SURETY COMPANY REFERENCE No. _____

"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 held and bound unto the State of Michigan, "the Owner," as Obligee, in the amount of _____ Dollars (\$ _____), for the payment of which the Contractor and Surety bind themselves, their respective heirs, successors, legal representatives and assigns, jointly and severally, in compliance with 1963 PA 213, as amended, MCL 129.201 et seq.

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.

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 IS 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 must 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) must 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 must 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 must nevertheless remain in full force and effect, and the Owner must 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 Licensing and Regulatory Affairs, must be listed on the current U.S. Department of the Treasury Circular 570, and, unless otherwise authorized by the Owner in writing, must 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. _____

Email: _____

END OF SECTION 00620

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STATE OF MICHIGAN MODEL

Developed from FORMSPEC™ Michigan Model

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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**. The DTMB Superintendent Designation [form](#) must be completed by the Contractor and submitted before beginning any work.

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 (minimum amount to be the contract award amount) 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. To the extent applicable, Contractor will comply with federal and state (2023 PA 10, MCL 408.1101 to 408.1126), prevailing wage requirements.

*7.14.2. Federal Prevailing Wages -The federal prevailing wage requirements in the attached Federal Provisions Addendum apply when the Davis-Bacon Act ([40 USC 3141-3148](#)) as supplemented by Department of Labor regulations ([29 CFR Part 5](#), "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction") applies.

7.14.3. State Prevailing Wages-The following provisions of this Article 7.14.3 apply when 2023 PA 10 applies.

7.14.3.1. Prevailing Wage and Fringe Benefits--The rates of wages and fringe benefits to be paid to each class of Construction Mechanic by Contractor and Subcontractors, shall not be less than the wage rates and fringe benefit rates prevailing in the locality in which the work is performed.

7.14.3.2 Nondiscrimination, Nonretaliation- Contractor or a Subcontractor shall not discharge, discipline, retaliate against, or otherwise discriminate against a Construction Mechanic, or threaten to do any of these things, because the Construction Mechanic reported or was about to report a violation or suspected violation of the act.

7.14.3.3. Construction Mechanics under this Contract are intended beneficiaries of the contractual prevailing wage, fringe benefit, and nondiscrimination nonretaliation requirements of the

Contract. Any such Construction Mechanic aggrieved by failure of a contractor or subcontractor to pay prevailing wages or benefits as specified in the Contract, or by violation of section 7 of 2023 PA 10, in addition to any other remedies provided by law, may bring an action in a court of competent jurisdiction against such contractor or subcontractor for damages or injunctive relief and may be awarded reinstatement or other appropriate relief, and all damages sustained, together with actual costs and attorney fees at trial and on appeal.

7.14.3.4. Contractor and Subcontractors shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in this Contract and shall keep an accurate record showing the name and occupation of and the actual wages and benefits paid to each Construction Mechanic employed by it in connection with the Contract. This record shall be available for reasonable inspection by the State.

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, inspection, testing 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 2013 PA 174, as amended, MCL 460.721 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 2013 PA 174, as amended, MCL 460.721 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 **Contractor** under this requirement. Such duties and responsibilities are for the benefit of the parties on the other work to the extent there 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.

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

SECTION 00800 SUPPLEMENTARY CONDITIONS

PROFESSIONAL – Beckett & Raeder, Inc.

WORK – Construct MVSBS Howell

FILE No. – 511/24024.CAK

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.

ARTICLE 4 CONTROL OF THE WORK – GENERAL PROVISIONS

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.

ARTICLE 7 LEGAL AND CONTRACTUAL REQUIREMENTS; INSURANCE

7.14.3 FEDERALLY FUNDED PROJECT PREVAILING WAGE REQUIREMENTS

If a project is funded in whole or in part by federal dollars, the Contractor and all Subcontractors must comply with the most recent version of Federal Provisions Addendum and all Laws pertaining to occupational classifications and prevailing wage requirements as follows:

1. FEDERAL PROVISIONS ADDENDUM
 - a. The most current version of Federal Provisions Addendum shall apply to this contract and is included in Appendix III.
2. DAVIS BACON ACT WAGE AND CLASSIFICATIONS
 - a. If applicable, the Contractor (and its Subcontractors) for prime construction contracts in excess of \$2,000 must comply with the Davis-Bacon Act ([40 USC 3141-3148](#)) as supplemented by Department of Labor regulations ([29 CFR Part 5](#), "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction").
 - b. The Contractor (and its Subcontractors) shall pay 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, regardless of any contractual relationship which may be alleged to exist between the Contractor or subcontractor and the laborers and mechanics.
 - c. The Contractor will post the scale of wages to be paid in a prominent and easily accessible place at the site of the work.
 - d. There may be withheld from the Contractor so much of accrued payments as the contracting officer considers necessary to pay to laborers and mechanics employed by the Contractor or any Subcontractor on the work the difference between the rates of wages required by the Contract to be paid laborers and mechanics on the work and the rates of wages received by the laborers and mechanics and not refunded to the Contractor or Subcontractors or their agents.
 - e. The Contractor shall maintain payrolls and basic records relating thereto for a period of three (3) years after the project; contractor shall submit Certified Payroll Reports using US Department of Labor Wage and Hour Division Form WH-347 for each weekly payroll to support and document compliance with the Davis Bacon Wage rates.
 - f. Davis Bacon wage and classification schedules applicable for this project/location are included in Appendix III.

ARTICLE 15 DISPUTES

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.

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

PART 3 – EXECUTION

3.01 FLOAT TOLERANCES

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.

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

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.

END OF SECTION 01310

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.

SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Closeout procedures.
- B. Final cleaning.
- C. Protecting installed construction.
- D. Project record documents.
- E. Operation and maintenance data.
- F. Product warranties and product bonds.

1.2 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect/Engineer's review.
- B. Provide Operations and Maintenance Manual to the Architect/Engineer for review prior to final submittal. Make corrections if any as directed by the Architect/Engineer and submit corrected manuals.
- C. Provide submittals to Architect/Engineer required by authorities having jurisdiction. These include, but are not limited to, pre-engineered building sealed structural calculations.
- D. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.3 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
- B. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces.
- C. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.
- D. Clean debris from drainage systems.
- E. Clean site; sweep paved areas, rake clean landscaped surfaces.

- F. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.4 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual specification sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Protect finished floors and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- E. Prohibit traffic from landscaped areas.

1.5 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1 Drawings.
 - 2 Specifications.
 - 3 Change Orders and other modifications to the Contract.
 - 4 Reviewed Shop Drawings, Product Data, and Samples.
 - 5 Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress, not less than weekly.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1 Manufacturer's name and product model and number.
 - 2 Product substitutions or alternates utilized.
 - 3 Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1 Measured depths of foundations in relation to finish floor datum of the existing Armory Building.
 - 2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3 Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4 Field changes of dimension and detail.
 - 5 Details not on original Contract drawings.

- G. Submit documents to Architect/Engineer with claim for final Application for Payment.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit data bound in 8-1/2 x 11 inch (A4) text pages, two (2) D side ring binders with durable covers and four (4) USB drives.
- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
- C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Certificates.
 - d. Originals of warranties.
- F. Parts and Finishes:
 - 1. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom manufactured products.
 - 2. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
 - 3. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation.

Include recommendations for inspections, maintenance, and repair.

4. Additional Requirements: As specified in individual product specification sections.

1.8 PRODUCT WARRANTIES AND PRODUCT BONDS

- A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within fourteen days after completion of applicable item of work.
- B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.
- C. Verify documents are in proper form, contain full information, and are notarized.
- D. Co-execute submittals when required.
- E. Include Table of Contents and assemble in three D side ring binder with durable cover.
- F. Submit prior to final Application for Payment.
- G. Time Of Submittals:
 - 1 For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within fourteen days after acceptance.
 - 2 Make other submittals within thirty days after Date of Substantial Completion, prior to final Application for Payment.
 - 3 For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within thirty days after acceptance, listing date of acceptance as beginning of warranty or bond period.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

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. Form-facing material for cast-in-place concrete.
 - 2. Shoring, bracing, and anchoring.

1.3 DEFINITIONS

- A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.
- B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each of the following:
 - 1. Exposed surface form-facing material.
 - 2. Concealed surface form-facing material.
 - 3. Form ties.
 - 4. Form-release agent.
- B. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.
 - 1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
 - 2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with **ACI 301 (ACI 301M)**.
 - a. Location of construction joints is subject to approval of the Architect.
 - 3. Indicate form liner layout and form line termination details.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with 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, so that resulting concrete conforms to the required shapes, lines, and dimensions.
1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
 2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

2.2 FORM-FACING MATERIALS

- A. As-Cast Surface Form-Facing Material:
1. Provide continuous, true, and smooth concrete surfaces.
 2. Furnish in largest practicable sizes to minimize number of joints.
 3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:
 - a. Plywood, metal, or other approved panel materials.
 - b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - 1) APA HDO (high-density overlay).
 - 2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
 - 3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
 - 4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.
- B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
1. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 RELATED MATERIALS

- A. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- B. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
 2. Form release agent for form liners shall be acceptable to form liner manufacturer.

- C. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than **1 inch (25 mm)** to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than **1 inch (25 mm)** in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

- A. Comply with **ACI 301 (ACI 301M)**.
- 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)** and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes.
- C. Limit concrete surface irregularities as follows:
 - 1. Surface Finish-1.0: ACI 117 Class D, **1 inch (25 mm)**.
 - 2. Surface Finish-2.0: ACI 117 Class B, **1/4 inch (6 mm)**.
 - 3. Surface Finish-3.0: ACI 117 Class A, **1/8 inch (3.0 mm)**.
- D. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Minimize joints.
 - 2. Exposed Concrete: Symmetrically align joints in forms.
- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
 - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 - 1. Provide and secure units to support screed strips
 - 2. Use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.

1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 2. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete, except at as noted on the drawings.
- J. At construction joints, overlap forms onto previously placed concrete not less than **12 inches (305 mm)**.
- K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
1. Determine sizes and locations from trades providing such items.
 2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.
- L. Construction and Movement Joints:
1. Construct joints true to line with faces perpendicular to surface plane of concrete.
 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 3. Place joints perpendicular to main reinforcement.
 4. Space vertical joints in walls.
 - a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
- 3.2 INSTALLATION OF EMBEDDED ITEMS
- 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.
1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

3. Clean embedded items immediately prior to concrete placement.

3.3 REMOVING AND REUSING FORMS

- A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
- B. Clean and repair surfaces of forms to be reused in the Work.
 1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
 2. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
 1. Align and secure joints to avoid offsets.
 2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
 1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
 2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.

END OF SECTION 031000

SECTION 032000 - CONCRETE REINFORCING

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. Steel reinforcement bars.
 - 2. Welded-wire reinforcement.
- B. Related Requirements:
 - 1. Section 321313 "Concrete Paving" for reinforcing related to concrete pavement and walks.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Each type of steel reinforcement.
 - 2. Bar supports.
 - 3. Mechanical splice couplers.
- B. Shop Drawings: Comply with ACI SP-066:
 - 1. Include placing drawings that detail fabrication, bending, and placement.
 - 2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
- C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
 - 1. Location of construction joints is subject to approval of the Architect.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
 - 1. Reinforcement To Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M

- B. Material Test Reports: For the following, from a qualified testing agency:
 - 1. Steel Reinforcement:
 - a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.
 - 2. Mechanical splice couplers.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
 - 1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, **Grade 60 (Grade 420)**, deformed.
- B. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- C. Headed-Steel Reinforcing Bars: ASTM A970/A970M.
- D. Steel Bar Mats: ASTM A184/A184M, fabricated from **ASTM A615/A615M, Grade 60 (Grade 420)**, deformed bars, assembled with clips.
- E. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- F. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

2.2 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A615/A615M, **Grade 60 (Grade 420)**, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
 - 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

- C. Mechanical Splice Couplers: **ACI 318 (ACI 318M)** Type 1 or Type 2, same material of reinforcing bar being spliced; tension-compression type or mechanical-lap type.
- D. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than **0.0508 inch (1.2908 mm)** in diameter.
 - 1. Finish: Plain.

2.3 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Do not cut or puncture vapor retarder.
 - 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than **1 inch (25 mm)**, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with **ACI 318 (ACI 318M)**.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or **24 inches (610 mm)**, whichever is greater.
 - 2. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
- G. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
 - a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed **12 inches (305 mm)**.
2. Lap edges and ends of adjoining sheets at least one wire spacing plus **2 inches (50 mm)** for plain wire and **8 inches (200 mm)** for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 1. Place joints perpendicular to main reinforcement.
 2. Continue reinforcement across construction joints unless otherwise indicated.
 3. Do not continue reinforcement through sides of strip placements of floors and slabs.
- B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

- A. Comply with **ACI 117 (ACI 117M)**.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
 1. Steel-reinforcement placement.
 2. Steel-reinforcement mechanical splice couplers.
 3. Steel-reinforcement welding.

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

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. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

- B. Related Requirements:

- 1. Section 031000 "Concrete Forming and Accessories" for form-facing materials.
 - 2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
 - 3. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.
 - 4. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

- A. Product Data: For each of the following.

- 1. Portland cement.
 - 2. Fly ash.
 - 3. Slag cement.
 - 4. Blended hydraulic cement.
 - 5. Silica fume.
 - 6. Performance-based hydraulic cement
 - 7. Aggregates.
 - 8. Admixtures:

- a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at

time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

9. Floor and slab treatments.
10. Liquid floor treatments.
11. Curing materials.

a. Include documentation from color pigment manufacturer, indicating that proposed methods of curing are recommended by color pigment manufacturer.

12. Joint fillers.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Slump limit.
6. Air content.
7. Nominal maximum aggregate size.
8. Intended placement method.
9. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - a. Location of construction joints is subject to approval of the Architect.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Bonding agents.
5. Liquid Floor Treatments.
6. Semirigid joint filler.
7. Joint-filler strips.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.

3. Slag cement.
4. Blended hydraulic cement.
5. Silica fume.
6. Performance-based hydraulic cement.
7. Aggregates.
8. Admixtures:

- a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician.
 1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.
- B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
 1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C94/C94M and **ACI 301 (ACI 301M)**.

1.8 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with **ACI 301 (ACI 301M)** and ACI 306.1 and as follows.
 1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 2. When average high and low temperature is expected to fall below **40 deg F (4.4 deg C)** for three successive days, maintain delivered concrete mixture temperature within the temperature range required by **ACI 301 (ACI 301M)**.
 3. Do not use frozen materials or materials containing ice or snow.
 4. Do not place concrete in contact with surfaces less than **35 deg F (1.7 deg C)**, other than reinforcing steel.
 5. 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)** and **ACI 305.1 (ACI 305.1M)**, and as follows:
 1. Maintain concrete temperature at time of discharge to not exceed **95 deg F (35 deg C)**.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with **ACI 301 (ACI 301M)** unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I/II, gray.
2. Fly Ash: ASTM C618, Class C or F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
4. Silica Fume: ASTM C1240 amorphous silica.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S, Class 3M, or Class 1N coarse aggregate or better, graded. Provide aggregates from a single source.

1. Alkali-Silica Reaction: Comply with one of the following:
 - a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
 - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
 - c. Alkali Content in Concrete: Not more than **4 lb./cu. yd. (2.37 kg/cu. m)** for moderately reactive aggregate or **3 lb./cu. yd. (1.78 kg/cu. m)** for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with **ACI 301 (ACI 301M)**.
2. Maximum Coarse-Aggregate Size: **3/4 inch (19 mm)** nominal.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Lightweight Aggregate: ASTM C330/C330M, **3/4-inch (19-mm)** nominal maximum aggregate size.

E. Air-Entraining Admixture: ASTM C260/C260M.

F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures 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 C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

G. Water and Water Used to Make Ice: ASTM C94/C94M, potable.

2.3 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

2.4 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 C171, polyethylene film burlap-polyethylene sheet.

1. Color:

- a. Ambient Temperature Below 50 deg F (10 deg C): Black.
- b. Ambient Temperature between 50 deg F (10 deg C) and 85 deg F (29 deg C): Any color.
- c. Ambient Temperature Above 85 deg F (29 deg C): White.

D. Water: Potable or complying with ASTM C1602/C1602M.

E. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

F. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.5 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 or aromatic polyurea with a Type A shore durometer hardness range of 90 to 95 in accordance with ASTM D2240.

C. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

- D. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.6 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, in accordance with **ACI 301 (ACI 301M)**.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Other Pozzolans: 25 percent by mass.
2. Slag Cement: 50 percent by mass.
3. Silica Fume: 10 percent by mass.
4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use 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, and concrete with a w/cm below 0.50.

2.7 CONCRETE MIXTURES

- A. Class A: Normal-weight concrete used for footings, grade beams, and tie beams.

1. Exposure Class: **ACI 318 (ACI 318M) F1**.
2. Minimum Compressive Strength: **3000 psi (20.7 MPa)** at 28 days.
3. Maximum w/cm: 0.55.
4. Slump Limit: **4 inches (100 mm)**, plus or minus **1 inch (25 mm)**.
5. Air Content:

- a. Exposure Class F1: 5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing **3/4-inch (19-mm)** nominal maximum aggregate size.

- B. Class B: Normal-weight concrete used for foundation walls.

1. Exposure Class: **ACI 318 (ACI 318M) F3**.

2. Minimum Compressive Strength: 3500 psi (24.1 MPa) at 28 days.
3. Maximum w/cm: 0.50.
4. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
5. Air Content:
 - a. Exposure Classes F2 and F3: 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size.

C. Class C: Normal-weight concrete used for exterior slabs-on-ground.

1. Exposure Class: ACI 318 (ACI 318M) S1.
2. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
3. Maximum w/cm: 0.40.
4. Slump Limit: 6 inches (125 mm), plus or minus 1 inch (25 mm).
5. Air Content:
 - a. Exposure Classes S1: 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size.

D. Class C: Normal-weight concrete used for interior slabs-on-ground.

1. Exposure Class: ACI 318 (ACI 318M) S2.
2. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
3. Maximum w/cm: 0.45.
4. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
5. Air Content:
 - a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
 2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

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.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.4 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
2. Place joints perpendicular to main reinforcement.
 - a. Continue reinforcement across construction joints unless otherwise indicated.
 - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.

4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 6. Space vertical joints in walls. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
 7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 8. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least **one-fourth** of concrete thickness as follows:
1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of **1/8 inch (3.2 mm)**. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form control 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 cracks.
- D. Isolation Joints in Slabs-on-Ground: 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.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
 2. Terminate full-width joint-filler strips not less than **1/2 inch (13 mm)** or more than **1 inch (25 mm)** below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints:
1. Install dowel bars and support assemblies at joints where indicated on Drawings.
 2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.
- F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.5 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of **ACI 301 (ACI 301M)**, but not to exceed the amount indicated on the concrete delivery ticket.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- E. 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.
 - 1. If a section cannot be placed continuously, provide construction joints as indicated.
 - 2. Deposit concrete to avoid segregation.
 - 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with **ACI 301 (ACI 301M)**.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least **6 inches (150 mm)** into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- F. 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. Do not place concrete floors and slabs in a checkerboard sequence.
 - 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 3. Maintain reinforcement in position on chairs during concrete placement.
 - 4. Scream slab surfaces with a straightedge and strike off to correct elevations.
 - 5. Level concrete, cut high areas, and fill low areas.
 - 6. Slope surfaces uniformly to drains where required.
 - 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 - 8. Do not further disturb slab surfaces before starting finishing operations.

3.6 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. **ACI 301 (ACI 301M)** Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
 - a. Patch voids larger than **1-1/2 inches (38 mm)** wide or **1/2 inch (13 mm)** deep.
 - b. Remove projections larger than **1 inch (25 mm)**.
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: **ACI 117 (ACI 117M)** Class D.
 - e. Apply to concrete surfaces not exposed to public view.

2. **ACI 301 (ACI 301M)** Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
 - a. Patch voids larger than **3/4 inch (19 mm)** wide or **1/2 inch (13 mm)** deep.
 - b. Remove projections larger than **1/4 inch (6 mm)**.
 - c. Patch tie holes.
 - d. Surface Tolerance: **ACI 117 (ACI 117M)** Class B.
 - e. Locations: Apply to concrete surfaces exposed to public view.

3. **ACI 301 (ACI 301M)** Surface Finish SF-3.0:
 - a. Patch voids larger than **3/4 inch (19 mm)** wide or **1/2 inch (13 mm)** deep.
 - b. Remove projections larger than **1/8 inch (3 mm)**.
 - c. Patch tie holes.
 - d. Surface Tolerance: **ACI 117 (ACI 117M)** Class A.
 - e. Locations: Apply to concrete surfaces exposed to public view, and to receive a rubbed finish.

B. Rubbed Finish: Apply the following to as cast surface finishes where indicated on Drawings:

1. Smooth-Rubbed Finish:
 - a. Perform no later than one day after form removal.
 - b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
 - c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.

2. Cork-Floated Finish:
 - a. Mix 1 part portland cement to 1 part fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint.
 - b. Mix 1 part portland cement and 1 part fine sand with sufficient water to produce a mixture of stiff grout. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
 - c. Wet concrete surfaces.
 - d. Compress grout into voids by grinding surface.
 - e. In a swirling motion, finish surface with a cork float.

C. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.7 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with **ACI 117 (ACI A117M)** tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view.
7. Finish surfaces to the following tolerances, in accordance with **ASTM E1155 (ASTM E1155M)**, for a randomly trafficked floor surface:

a. Slabs on Ground:

- 1) Finish and measure surface so gap at any point between concrete surface and an unveled, 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. Broom Finish: Apply a broom finish to exterior slab on grade.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

E. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces in accordance with manufacturer's written instructions and as follows:

1. Uniformly apply dry-shake floor hardener at a rate of 100 lb/100 sq. ft. (49 kg/10 sq. m) unless greater amount is recommended by manufacturer.
2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating.
3. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
4. After final floating, apply a trowel finish.
5. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

3.8 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.9 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 (ACI 301M) and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h (1 kg/sq. m x h), calculated in accordance with ACI 305.1, before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
 - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.

- e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
 - 2) Maintain continuity of coating and repair damage during curing period.

- C. Curing Unformed Surfaces: Comply with **ACI 308.1 (ACI 308.1M)** as follows:
 - 1. Begin curing immediately after finishing concrete.
 - 2. Interior Concrete Floors:
 - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than **12-inches (300-mm)**.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but 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.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
 - b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than **12 inches (300 mm)**.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but 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.

- a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
- 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
- a) Water.
 - b) Continuous water-fog spray.

c. Floors to Receive Curing Compound:

- 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
- 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
- 3) Maintain continuity of coating, and repair damage during curing period.
- 4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

d. Floors to Receive Curing and Sealing Compound:

- 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
- 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
- 3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.10 TOLERANCES

- A. Conform to **ACI 117 (ACI 117M)**.

3.11 APPLICATION OF LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than three days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
4. Rinse with water; remove excess material until surface is dry.
5. Apply a second coat in a similar manner if surface is rough or porous.

- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

3.12 JOINT FILLING

- A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least one month.
 - 2. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least **2 inches (50 mm)** deep in formed joints.
- D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
 - 1. Repair and patch defective areas when approved by Architect.
 - 2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a **No. 16 (1.18-mm)** sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than **1/2 inch (13 mm)** in any dimension to solid concrete.
 - a. Limit cut depth to **3/4 inch (19 mm)**.
 - b. Make edges of cuts perpendicular to concrete surface.
 - c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
 - d. Fill and compact with patching mortar before bonding agent has dried.
 - e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
 - a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
 - b. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
 - a. Correct low and high areas.
 - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of **0.01 inch (0.25 mm)** wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
 - a. Finish repaired areas to blend into adjacent concrete.
5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
 - a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - b. Feather edges to match adjacent floor elevations.
6. Correct other low areas scheduled to remain exposed with repair topping.
 - a. Cut out low areas to ensure a minimum repair topping depth of **1/4 inch (6 mm)** to match adjacent floor elevations.
 - b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
7. Repair defective areas, except random cracks and single holes **1 inch (25 mm)** or less in diameter, by cutting out and replacing with fresh concrete.
 - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a **3/4-inch (19-mm)** clearance all around.
 - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
 - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
 - d. Place, compact, and finish to blend with adjacent finished concrete.
 - e. Cure in same manner as adjacent concrete.
8. Repair random cracks and single holes **1 inch (25 mm)** or less in diameter with patching mortar.
 - a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.

- b. Dampen cleaned concrete surfaces and apply bonding agent.
 - c. Place patching mortar before bonding agent has dried.
 - d. Compact patching mortar and finish to match adjacent concrete.
 - e. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- 1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
 - 2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
 - 3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
 - a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.
 - 8) Date and time sample was obtained.
 - 9) Truck and batch ticket numbers.
 - 10) Design compressive strength at 28 days.
 - 11) Concrete mixture designation, proportions, and materials.
 - 12) Field test results.
 - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
 - 14) Type of fracture and compressive break strengths at seven days and 28 days.
- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size,

design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Architect.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C143/C143M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M:
 - a. One test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and laboratory cure two sets of four 6-inch (150 mm) by 12-inch (300 mm) or 4-inch (100 mm) by 8-inch (200 mm) cylinder specimens for each composite sample.
 - b. Cast, initial cure, and field cure four standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C39/C39M.

- a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
 8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than **500 psi (3.4 MPa)** if specified compressive strength is **5000 psi (34.5 MPa)**, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than **5000 psi (34.5 MPa)**.
 10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 11. Additional Tests:
 - a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
 - 1) Acceptance criteria for concrete strength shall be in accordance with **ACI 301 (ACI 301M)**, section 1.6.6.3.
 12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- F. Measure floor and slab flatness and levelness in accordance with **ASTM E1155 (ASTM E1155M)** within 48 hours of completion of floor finishing and promptly report test results to Architect.

3.15 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

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DMVA Project No. 26B3523004

END OF SECTION 033000

SECTION 072100 - THERMAL INSULATION

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. Extruded polystyrene foam-plastic board insulation.
 - 2. Glass-fiber blanket insulation.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Extruded polystyrene foam-plastic board insulation.
 - 2. Glass-fiber blanket insulation.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. Extruded Polystyrene Board Insulation, Type X: ASTM C578, Type X, 15-psi (104-kPa) minimum compressive strength; unfaced.
 - 1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 - 2. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
 - 3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

2.2 GLASS-FIBER BLANKET INSULATION

- A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
 - 1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 - 2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 - 3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.
 - 4. Thickness: Minimum 3-1/2 inch blanket.
 - 5. R-Value: R-13 minimum.
 - 6. Location: At underside of the roof panels.

- B. Glass-Fiber Blanket Insulation, Polypropylene-Scrim-Kraft Faced: ASTM C665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).
 - 1. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.
 - 2. Thickness: Nominal 9-1/2 inch blanket.
 - 3. R-Value: R-30 minimum.
 - 4. Location: Below the unfaced insulation blanket.

2.3 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 - 1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
 - 2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

- B. 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.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 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. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. 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.

3.3 THERMAL INSULATION INSTALLATION

- A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.
 - 1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
 - 2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
 - 3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.
 - 4. Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation, with both sets of facing tabs sealed, to provide a complete vapor retarder.
- B. Blanket Roof Insulation: Comply with the following installation method:
 - 1. Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.
 - a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
 - 2. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

3.4 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 as follows:
 - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions.
 - 2. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
 - 3. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.

4. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
 5. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.
- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.5 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072600 - VAPOR RETARDERS

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. Polyethylene vapor retarders.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for under-slab vapor retarders.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 POLYETHYLENE VAPOR RETARDERS

- A. Polyethylene Vapor Retarders: ASTM D4397, 10-mil- (0.25-mm-) thick sheet, with maximum permeance rating of 0.1 perm (5.7 ng/Pa x s x sq. m).

2.2 ACCESSORIES

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- B. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.2 INSTALLATION OF VAPOR RETARDERS UNDER CONCRETE SLAB

- A. Install vapor retarders over prepared grade. Lap joints a minimum of **12 inches (305 mm)** and seal with manufacturer's recommended tape. Install second layer over pathways to equipment.
- B. Extend vapor retarder over footings and seal to foundation wall or grade beam with manufacturer's recommended tape.
 - 1. Extend vapor retarder vertically minimum **16 inches (406 mm)** above top of footing.
- C. Seal around penetrations such as utilities and columns in order to create a monolithic, airtight membrane at grade surface, perimeter, and all vertical penetrations.

3.3 PROTECTION

- A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION 072600

SECTION 079200 - JOINT SEALANTS

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. Urethane joint sealants.
 - 2. Butyl joint sealants.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

1.4 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.
- B. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 50, Uses T and NT.

2.3 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.

2.4 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), or Type B (bicellular 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.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.5 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, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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 all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. 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 of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. 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.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. 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.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 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 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
 - b. Perform one test for each 1000 feet (300 m) 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 C1193 or Method A, Tail Procedure, in ASTM C1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 - 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether

joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.

5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

- 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.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:

- a. Isolation and contraction joints in cast-in-place concrete slabs.

2. Joint Sealant: Urethane, M, P, 50, T, NT.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

- B. Joint-Sealant Application: Exterior joints in vertical surfaces.

1. Joint Locations:

- a. Construction joints in cast-in-place concrete.

- b. Joints between metal panels.

- c. Joints between different materials listed above.

- d. Perimeter joints between materials listed above and frames of doors and louvers.

2. Joint Sealant: Urethane, nonstaining, S, NS, 100/50, T, NT.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:

- a. Isolation joints in cast-in-place concrete slabs.
 1. Joint Sealant: Urethane, M, P, 50, T, NT.
 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces.
 1. Joint Locations:
 - a. Control joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors and louvers.
 2. Joint Sealant: Urethane, nonstaining, S, NS, 100/50, T, NT.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Concealed mastics.
 1. Joint Locations:
 - a. Aluminum thresholds.
 - b. Sill plates.
 - c. Metal panels.
 2. Joint Sealant: Butyl-rubber based.
 3. Joint-Sealant Color: As indicated by manufacturer's designations.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

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. Exterior standard steel doors and frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
- C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Maximum-Duty Doors and Frames: ANSI/SDI A250.8, Level 4; ANSI/SDI A250.4, Level A.
 - 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.067 inch (1.7 mm), with minimum A60 (ZF180) coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Edge Bevel: Bevel lock edge 1/8 inch in 2 inches (3.2 mm in 51 mm).
 - f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - g. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - h. Core: Polyurethane or Polyisocyanurate.
 - 2. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch (1.7 mm), with minimum A60 (ZF180) coating.
 - b. Construction: Full profile welded.
 - 3. Exposed Finish: Prime.

2.2 FRAME ANCHORS

- A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each **24 inches (610 mm)** of frame height above **7 feet (2.1 m)**.
 3. Postinstalled Expansion Anchor: Minimum **3/8-inch- (9.5-mm-)** diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than **2-inch (51-mm)** height adjustment. Terminate bottom of frames at top of underlayment.
- D. Material: ASTM A879/A879M, Commercial Steel (CS), **04Z (12G)** coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.3 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.
- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

2.4 FABRICATION

- A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

2.5 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

- A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.
1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 2. Floor Anchors: Secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Solidly pack mineral-fiber insulation inside frames.
 4. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus **1/16 inch (1.6 mm)**, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs on a horizontal line parallel to plane of wall.
 - c. 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 wall.
 - d. Plumbness: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.

3.3 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 083613 - SECTIONAL DOORS

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 manually operated sectional doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
 - 2. Include rated capacities, operating characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
- C. Samples for Initial Selection: For units with factory-applied finishes.
 - 1. Include Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sectional doors to include in maintenance manuals.

1.6 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.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:

- a. Structural failures including, but not limited to, excessive deflection.
 - b. Failure of components before reaching required number of operation cycles.
 - c. Faulty operation of hardware.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
 - e. Delamination of exterior or interior facing materials.

- 2. Warranty Period: 3 years from date of Substantial Completion against failures of tracks and mechanical parts.

- 3. Warranty Period: 10 from date of Substantial Completion against delamination of foam insulation from the steel face.

- B. Special Finish Warranty: Manufacturer agrees to repair or replace components that show 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 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain sectional doors from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Sectional doors shall comply with performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction.

- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.

- 1. Design Wind Load: As indicated on Drawings.
 - 2. Testing: According to ASTM E330.
 - 3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.

- a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of the door width.
 - b. Deflection of horizontal track assembly shall not exceed 1/240 of the door height.
4. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.

2.3 DOOR ASSEMBLY

- A. Steel Sectional Door: Sectional door formed with hinged sections and fabricated according to DASMA 102 unless otherwise indicated.
- B. Operation Cycles: Door components and operators capable of operating for not less than 25,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Air Infiltration: Maximum rate of 0.1 cfm/sq. ft. (0.05 L/s per sq. m) at 15 and 25 mph (24.1 and 40.2 km/h) when tested according to ASTM E283.
- D. R-Value: 17.5 for total door thickness. U-Value: 0.057.
- E. Steel Sections: Zinc-coated (galvanized) steel sheet with G90 (Z275) zinc coating.
 1. Section Thickness: 2 inches (51 mm).
 2. Exterior-Face, Steel Sheet Thickness: 0.019-inch- (0.48-mm-) nominal coated thickness.
 - a. Surface: Flush, textured.
 3. Insulation: Foamed in place.
 4. Interior Facing Material: Zinc-coated (galvanized) steel sheet with a nominal coated thickness of 0.019 inch (0.48 mm).
- F. Track Configuration: Standard-lift track.
- G. Weatherseals: Fitted to bottom and top and around entire perimeter of door.
- H. Roller-Tire Material: Manufacturer's standard.
- I. Locking Devices: Equip door with locking device assembly.
 1. Locking Device Assembly: locking bars, operable from inside with thumbturn and outside with cylinder.
- J. Counterbalance Type: Torsion spring.
- K. Manual Door Operator: Chain-hoist operation.
- L. Door Finish:
 1. Powder-Coat Finish: Color and gloss as selected by Architect from manufacturer's full range.
 2. Factory Prime Finish: Manufacturer's standard color.

3. Finish of Interior Facing Material: Match finish of exterior section face.

2.4 STEEL DOOR SECTIONS

- A. Exterior Section Faces and Frames: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A653/A653M, with indicated zinc coating and thickness.
 1. Fabricate section faces from single sheets to provide sections not more than **24 inches (610 mm)** high and of indicated thickness. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weather-resistant seal, with a reinforcing flange return.
 2. For insulated doors, provide sections with continuous thermal-break construction, separating the exterior and interior faces of door.
- B. Section Ends: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than **0.064-inch- (1.63-mm-)** nominal coated thickness and welded to door section. Provide intermediate stiles formed from not less than **0.064-inch- (1.63-mm-)** thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than **48 inches (1219 mm)** apart.
- C. Reinforce bottom section with a continuous channel or angle conforming to bottom-section profile.
- D. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place.
- E. Provide reinforcement for hardware attachment.
- F. Foamed-in-Place Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free polyurethane insulation, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load, and with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84. Enclose insulation completely within steel sections and the interior facing material, with no exposed insulation.
- G. Interior Facing Material: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A653/A653M, with indicated thickness.
- H. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.

2.5 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances indicated on Drawings, Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides for required door type, size, weight, and loading.
 1. Galvanized Steel: ASTM A653/A653M, minimum **G60 (Z180)** zinc coating.
 2. Slope tracks at an angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.

3. Track Reinforcement and Supports: Galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches (51 mm) apart for door-drop safety device.
 - a. For Vertical Track: Intermittent, jamb brackets attached to track and attached to wall.
 - b. For Horizontal Track: Continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.

- B. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.

2.6 HARDWARE

- A. General: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

- B. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch- (2.01-mm-) nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible. Provide double-end hinges where required, for doors more than 16 feet (4.88 m) wide unless otherwise recommended by door manufacturer.

- C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch- (76-mm-) diameter roller tires for 3-inch- (76-mm-) wide track and 2-inch- (51-mm-) diameter roller tires for 2-inch- (51-mm-) wide track.

- D. Push/Pull Handles: Equip each push-up operated or emergency-operated door with galvanized-steel lifting handles on each side of door, finished to match door.

2.7 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 1. Lock Cylinders: Cylinders standard with manufacturer.
 2. Keys: Two for each cylinder.

2.8 COUNTERBALANCE MECHANISM

- A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A229/A229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.

- B. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.
- C. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
- D. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

2.9 MANUAL DOOR OPERATORS

- A. Chain-hoist Operation: Endless steel hand chain for raising and lowering doors, with counterbalance mechanism designed so that required lift or pull for door operation does not exceed 25 lbf (111 N). Provide alloy-steel hand chain with chain holder secured to operator guide.

2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 STEEL AND GALVANIZED-STEEL FINISHES

- A. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
- B. Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Tracks:
 - 1. Fasten vertical track assembly to opening jambs and framing, spaced not more than **24 inches (610 mm)** apart.
 - 2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.
- D. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780/A780M.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

SECTION 087100 - DOOR HARDWARE

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. Mechanical door hardware for the following:
 - a. Swinging doors.
 - 2. Cylinders for door hardware specified in other Sections.
- B. Related Requirements:
 - 1. Section 081113 "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.

1.3 COORDINATION

- A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.

2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
 3. Content: Include the following information:
 - a. Identification number, location, hand, fire rating, size, and material of each door and frame.
 - b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - d. Fastenings and other installation information.
 - e. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
 - f. Mounting locations for door hardware.
 - g. List of related door devices specified in other Sections for each door and frame.
- C. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals.
- B. Schedules: Final door hardware schedule.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.
 1. Warehousing Facilities: In Project's vicinity.
 2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC).

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of door hardware from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Means of Egress Doors: Latches do not require more than **15 lbf (67 N)** to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

2.3 CONTINUOUS HINGES

- A. Continuous Hinges: BHMA A156.26; minimum **0.120-inch- (3.0-mm-)** thick, hinge leaves with minimum overall width of **4 inches (102 mm)**; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
- B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

2.4 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
 2. Deadbolts: Minimum 1-inch (25-mm) bolt throw.
- C. Lock Backset: 2-3/4 inches (70 mm) unless otherwise indicated.
- D. Lock Trim:
1. Levers:
 - a. Sargent model MI.
 - b. Schlage model 02.
 - c. Approved equal of other brand.
 2. Escutcheons:
 - a. Sargent model CE Escutcheon.
 - b. Schlage model L Full Face.
 - c. Approved equal of other brand.
- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
- F. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.

2.5 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices.
- B. Standard Lock Cylinders: BHMA A156.5; Grade 1 permanent cores; face finished to match lockset.
1. Core Type: Interchangeable.
- C. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
- D. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 4 construction master keys.

2.6 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. Match existing keying system.
1. Keyed Alike: Key all cylinders to same change key.
- B. Keys: Nickel silver or Brass.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: Information to be furnished by Owner.

2.7 OVERHEAD STOPS AND HOLDERS

- A. Overhead Stops and Holders: BHMA A156.8.

2.8 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
- B. Maximum Air Leakage: When tested according to ASTM E283 with tested pressure differential of **0.3-inch wg (75 Pa)**, as follows:
 1. Smoke-Rated Gasketing: **0.3 cfm/sq. ft. (3 cu. m per minute/sq. m)** of door opening.
 2. Gasketing on Single Doors: **0.3 cfm/sq. ft. (3 cu. m per minute/sq. m)** of door opening.
 3. Gasketing on Double Doors: **0.50 cfm per foot (0.000774 cu. m/s per m)** of door opening.

2.9 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

2.10 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.
 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.
 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Fire-Rated Applications:
 - a. Wood or Machine Screws: For the following:
 - 1) Hinges mortised to doors or frames.
 - 2) Strike plates to frames.
 - 3) Closers to doors and frames.
 - b. Steel Through Bolts: For the following unless door blocking is provided:
 - 1) Surface hinges to doors.
 - 2) Closers to doors and frames.
 - 3) Surface-mounted exit devices.
3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.11 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as indicated in keying schedule.
 - 2. Furnish permanent cores to Owner for installation.
- E. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- F. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
 - 1. Do not notch perimeter gasketing to install other surface-applied hardware.
- G. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
 - 2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.

3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

3.7 DOOR HARDWARE SCHEDULE

A. Hardware Set 1: Each door to have the following:

1. Continuous Hinge.
2. Mortise Lock – ANSI F07, Storeroom Lock.
3. Overhead Door Holder and Stop.
4. Threshold – Saddle Type.
5. Weatherstrip Gaskets and Door Sweep.

END OF SECTION 087100

SECTION 089119 - FIXED LOUVERS

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. Fixed extruded-aluminum louvers.

1.3 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. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).
- C. Vertical Louver: Louver with vertical blades (i.e., the axis of the blades are vertical).
- D. 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.
- E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing according to AMCA 500-L.
- F. Windborne-Debris-Impact-Resistant Louver: Louver that provides specified windborne-debris-impact resistance, as determined by testing according to AMCA 540.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
 - 2. Show mullion profiles and locations.

- C. Samples: For each type of metal finish required.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 WARRANTY

- A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain fixed louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

- A. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Drainable-Blade Louver <Insert drawing designation>:

1. Louver Depth: 4 inches (100 mm).
2. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm).
3. Louver Performance Ratings:
 - a. Free Area: Not less than 7.0 sq. ft. (0.65 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - b. Point of Beginning Water Penetration: Not less than 1000 fpm (5.1 m/s).
 - c. Air Performance: Not more than 0.15-inch wg (37-Pa) static pressure drop at 1000-fpm (5.1-m/s) free-area exhaust or intake velocity.
4. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 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 screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same type 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.

D. Louver Screening for Aluminum Louvers:

1. Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) wire.

2.5 MATERIALS

A. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B209 (ASTM B209M), Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.

- D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E488/E488M conducted by a qualified testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.6 FABRICATION

- A. Factory assemble louvers 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: Channel unless otherwise indicated.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide subsills made of same material as louvers for recessed louvers.
- F. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.7 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. 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 of the Work.
- B. 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 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. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- 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 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.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089119

SECTION 099000 - 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 and iron.
 - 2. Galvanized metal.

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 D523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

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.
 - 2. Indicate VOC content.
- B. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 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. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 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. Colors: As selected by Architect from manufacturer's full range.

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 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.
- C. 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.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
 - 1. SSPC-SP 2.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Paint entire exposed surface of window frames and sashes.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

- D. 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.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed to view:
 - a. Uninsulated metal piping.
 - b. Metal conduit.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. 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.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 PAINTING SCHEDULE

- A. Steel and Iron Substrates:
 - 1. Latex System, Alkyd Primer MPI INT 5.1Q:
 - a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #76.
 - b. Prime Coat: Shop primer specified in Section where substrate is specified.
 - c. Intermediate Coat: Latex, interior, matching topcoat, MPI #54
 - d. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.
 - 2. Alkyd System MPI EXT 5.1D:
 - a. Prime Coat: Primer, alkyd, anticorrosive, for metal, MPI #79.
 - b. Prime Coat: Shop primer specified in Section where substrate is specified.
 - c. Intermediate Coat: Exterior, alkyd enamel, matching topcoat, MPI #94.
 - d. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), MPI #94.
- B. Galvanized-Metal Substrates: (Where noted to be painted.)
 - 1. Alkyd over Water-Based Galvanized Primer System MPI INT 5.3L:
 - a. Prime Coat: Primer, water-based galvanized, MPI #134.
 - b. Intermediate Coat: Alkyd, interior, matching topcoat, MPI #94.

- c. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), MPI #94.
2. Alkyd over Water-Based Galvanized Primer System MPI EXT 5.3N:
- a. Prime Coat: Primer, water-based galvanized, MPI #134
 - b. Intermediate Coat: Exterior, alkyd enamel, matching topcoat, MPI #94.
 - c. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), MPI #94.

END OF SECTION 099113

SECTION 133419 - METAL BUILDING SYSTEMS

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. Structural-steel framing.
 - 2. Metal roof panels.
 - 3. Foamed-insulation-core metal wall panels.
 - 4. Accessories.

1.3 DEFINITIONS

- A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.

1.4 COORDINATION

- A. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."
- B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to metal building systems including, but not limited to, the following:
 - a. Condition of foundations and other preparatory work performed by other trades.
 - b. Structural load limitations.
 - c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
 - d. Required tests, inspections, and certifications.

- e. Unfavorable weather and forecasted weather conditions and impact on construction schedule.
2. Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:
 - a. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
 - b. Structural limitations of purlins and rafters during and after roofing.
 - c. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
 - d. Temporary protection requirements for metal roof panel assembly during and after installation.
 - e. Roof observation and repair after metal roof panel installation.
 3. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
 - a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
 - b. Structural limitations of girts and columns during and after wall panel installation.
 - c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
 - d. Temporary protection requirements for metal wall panel assembly during and after installation.
 - e. Wall observation and repair after metal wall panel installation.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of metal building system component.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Metal roof panels.
 - b. Foamed-insulation-core metal panels.
- B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:
 1. Anchor-Rod Plans: Submit anchor-rod plans and templates before foundation work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal building to foundation. Indicate column reactions at each location.
 2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
 3. Metal Roof and Wall Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.

- a. Show wall-mounted items including personnel doors, vehicular doors, louvers, and lighting fixtures.
- 4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:8):
 - a. Flashing and trim.
 - b. Gutters.
 - c. Downspouts.
- C. Samples for Initial Selection: For units with factory-applied finishes.
- D. Delegated-Design Submittal: For metal building systems.
 - 1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For erector and manufacturer.
- B. Welding certificates.
- C. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
 - 1. Name and location of Project.
 - 2. Order number.
 - 3. Name of manufacturer.
 - 4. Name of Contractor.
 - 5. Building dimensions including width, length, height, and roof slope.
 - 6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 - 7. Governing building code and year of edition.
 - 8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 - 9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 - 10. Building-Use Category: Indicate category of building use and its effect on load importance factors.
- D. Erector Certificates: For qualified erector, from manufacturer.
- E. Material Test Reports: For each of the following products:
 - 1. Structural steel including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shop primers.
 - 5. Nonshrink grout.

- F. Source quality-control reports.
- G. Field quality-control reports.
- H. Sample Warranties: For special warranties.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panel finishes to include in maintenance manuals.

1.9 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
 - 1. Accreditation: Manufacturer's facility accredited according to the International Accreditation Service's AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
 - 2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.
- B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Protect foam-plastic insulation as follows:
 - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.

3. Complete installation and concealment of foam-plastic materials as rapidly as possible in each area of construction.

1.11 FIELD CONDITIONS

- A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

1.12 WARRANTY

- A. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Finish Warranty Period: 30 years from date of Substantial Completion.
- B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.
 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

- A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.
- B. Primary-Frame Type:
 1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.

- C. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, consisting of primary frame, capable of supporting one-half of a bay design load, and end-wall columns.
- D. End-Wall Framing: Engineer end walls to be expandable. Provide primary frame, capable of supporting full-bay design loads, and end-wall columns.
- E. Secondary-Frame Type: Manufacturer's standard purlins and joists and exterior-framed (bypass) girts.
- F. Eave Height: as indicated by nominal height on Drawings.
- G. Bay Spacing: As indicated on Drawings.
- H. Roof Slope: 1 inch per 12 inches (1:12).
- I. Roof System: Manufacturer's standard standing-seam, trapezoidal-rib metal roof panels.
- J. Exterior Wall System: Manufacturer's standard foamed-insulation-core metal wall panels.

2.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal building system.
- B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
 - 1. Design Loads: As indicated on Drawings.
 - 2. Deflection and Drift Limits: Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."
 - 3. Deflection and Drift Limits: No greater than the following:
 - a. Purlins and Rafters: Vertical deflection of 1/180 of the span.
 - b. Girts: Horizontal deflection of 1/120 of the span.
 - c. Metal Roof Panels: Vertical deflection of 1/150 of the span.
 - d. Metal Wall Panels: Horizontal deflection of 1/180 of the span.
 - e. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
 - f. Lateral Drift: Maximum of 1/60 of the building height.
- C. Seismic Performance: Metal building system shall withstand the effects of earthquake motions determined according to Michigan Building Code 2015.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
 - E. Fire Propagation Characteristics: Exterior wall assemblies containing foam plastics pass NFPA 285 fire test.
 - F. Structural Performance for Metal Roof Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 1. Wind Loads: As indicated on Drawings.
 - G. Air Infiltration for Metal Roof Panels: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E1680 at the following test-pressure difference:
 1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).
 - H. Air Infiltration for Metal Wall Panels: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E283 at the following test-pressure difference:
 1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).
 - I. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E1646 at the following test-pressure difference:
 1. Test-Pressure Difference: 2.86 lbf/sq. ft. (137 Pa).
 - J. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 1. Test-Pressure Difference: 2.86 lbf/sq. ft. (137 Pa).
 - K. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 1. Uplift Rating: UL 90.
 - L. Thermal Performance for Opaque Elements: Provide the following maximum U-factors and minimum R-values when tested according to ASTM C1363 or ASTM C518:
 1. Walls:
 - a. R-Value: R-24.
- 2.4 STRUCTURAL-STEEL FRAMING
- A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."
 - B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 - C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

- D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
 - a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.
 2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
 3. Frame Configuration: One-directional, sloped.
 4. Exterior Column: Tapered.
 5. Rafter: Uniform depth or Tapered.
- E. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
 2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
- F. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:
1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum ~~2-1/2-inch-~~ (64-mm-) wide flanges.
 - a. Depth: As needed to comply with system performance requirements.
 2. Purlins: Steel joists of depths indicated on Drawings.
 3. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum ~~2-1/2-inch-~~ (64-mm-) wide flanges.
 - a. Depth: As required to comply with system performance requirements.
 4. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
 5. Flange Bracing: Minimum ~~2-by-2-by-1/8-inch~~ (51-by-51-by-3-mm) structural-steel angles or ~~1-inch-~~ (25-mm-) diameter, cold-formed structural tubing to stiffen primary-frame flanges.
 6. Sag Bracing: Minimum ~~1-by-1-by-1/8-inch~~ (25-by-25-by-3-mm) structural-steel angles.
 7. Base or Sill Angles: Manufacturer's standard base angle, minimum ~~3-by-2-inch~~ (76-by-51-mm), fabricated from zinc-coated (galvanized) steel sheet.
 8. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.

9. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
 10. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.
- G. Bracing: Provide adjustable wind bracing using any method as follows:
1. Rods: ASTM A36/A36M; ASTM A572/A572M, Grade 50 (345); or ASTM A529/A529M, Grade 50 (345); minimum 1/2-inch- (13-mm-) diameter steel; threaded full length or threaded a minimum of 6 inches (152 mm) at each end.
 2. Cable: ASTM A475, minimum 1/4-inch- (6-mm-) diameter, extra-high-strength grade, Class B, zinc-coated, seven-strand steel; with threaded end anchors.
 3. Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
 4. Diaphragm Action of Metal Panels: Design metal building to resist wind forces through diaphragm action of metal panels.
- H. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to foundation.
- I. Materials:
1. W-Shapes: ASTM A992/A992M; ASTM A572/A572M, Grade 50 or 55 (345 or 380); or ASTM A529/A529M, Grade 50 or 55 (345 or 380).
 2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A36/A36M; ASTM A572/A572M, Grade 50 or 55 (345 or 380); or ASTM A529/A529M, Grade 50 or 55 (345 or 380).
 3. Plate and Bar: ASTM A36/A36M; ASTM A572/A572M, Grade 50 or 55 (345 or 380); or ASTM A529/A529M, Grade 50 or 55 (345 or 380).
 4. Steel Pipe: ASTM A53/A53M, Type E or S, Grade B.
 5. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B or C, structural tubing.
 6. Structural-Steel Sheet: Hot-rolled, ASTM A1011/A1011M, Structural Steel (SS), Grades 30 through 55 (205 through 380), or High-Strength Low-Alloy Steel (HSLAS) or High-Strength Low-Alloy Steel with Improved Formability (HSLAS-F), Grades 45 through 70 (310 through 480); or cold-rolled, ASTM A1008/A1008M, Structural Steel (SS), Grades 25 through 80 (170 through 550), or HSLAS, Grades 45 through 70 (310 through 480).
 7. Joist Girders: Manufactured according to "Standard Specifications for Joist Girders," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated on Drawings and required for primary framing.
 8. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, (ASTM A563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 - a. Finish: Hot-dip zinc coating, ASTM F2329, Class C or Mechanically deposited zinc coating, ASTM B695, Class 50.
 9. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490 (Grade A490M), Type 1, heavy-hex steel structural bolts or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends; ASTM A563, Grade DH, (ASTM A563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

10. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends; **ASTM A563, Grade DH, (ASTM A563M, Class 10S)** heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1 hardened carbon-steel washers.
 - a. Finish: Mechanically deposited zinc coating, ASTM B695, Class 50 or Mechanically deposited zinc coating, ASTM B695, Class 50, baked-epoxy coated.
 11. Unheaded Anchor Rods: ASTM F1554, Grade 36.
 - a. Configuration: Straight.
 - b. Nuts: **ASTM A563 (ASTM A563M)** hex carbon steel.
 - c. Plate Washers: ASTM A36/A36M carbon steel.
 - d. Washers: **ASTM F436 (ASTM F436M)** hardened carbon steel.
 - e. Finish: Hot-dip zinc coating, ASTM F2329, Class C or Mechanically deposited zinc coating, ASTM B695, Class 50.
 12. Headed Anchor Rods: ASTM F1554, Grade 36.
 - a. Configuration: Straight.
 - b. Nuts: **ASTM A563 (ASTM A563M)** hex carbon steel.
 - c. Plate Washers: ASTM A36/A36M carbon steel.
 - d. Washers: **ASTM F436 (ASTM F436M)** hardened carbon steel.
 - e. Finish: Hot-dip zinc coating, ASTM F2329, Class C or Mechanically deposited zinc coating, ASTM B695, Class 50.
 13. Threaded Rods: ASTM A193/A193M.
 - a. Nuts: **ASTM A563 (ASTM A563M)** hex carbon steel.
 - b. Washers: ASTM A36/A36M carbon steel.
 - c. Finish: Hot-dip zinc coating, ASTM F2329, Class C or Mechanically deposited zinc coating, ASTM B695, Class 50.
- J. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.
1. Clean and prepare in accordance with SSPC-SP2.
 2. Coat with manufacturer's standard primer. Apply primer to primary and secondary framing to a minimum dry film thickness of **1 mil (0.025 mm)**.
 - a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of **0.5 mil (0.013 mm)** on each side.

2.5 METAL ROOF PANELS

- A. Standing-Seam, Trapezoidal-Rib, Metal Roof Panels: Formed with raised trapezoidal ribs at panel edges and flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.024-inch (0.61-mm)** nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

- a. Exterior Finish: Two-coat fluoropolymer.
 - b. Color: As selected by Architect from manufacturer's full range.
2. Clips: One-piece fixed or Two-piece floating to accommodate thermal movement.
 3. Joint Type: Panels snapped together.
 4. Panel Coverage: 24 inches (610 mm).
 5. Panel Height: nominal 3 inches (76 mm).
 6. Uplift Rating: UL 90.
- B. Finishes:
1. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2.6 FOAMED-INSULATION-CORE METAL WALL PANELS

- A. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.
1. Panel Thermal-Resistance Value (R-Value): R-24.
 2. Facing Material: Fabricate panel with exterior and interior facings of same material and thickness. Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.021-inch (0.53-mm) nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Exterior Surface: Striated.
 - b. Exterior Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
 3. Panel Coverage: 40 inches (1016 mm) nominal.
 4. Panel Thickness: 3 inches (76 mm).
 5. Insulation Core: Modified polyisocyanurate or polyurethane foam using a non-CFC blowing agent, foamed-in-place or board type, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.
 - a. Closed-Cell Content: 90 percent when tested according to ASTM D6226.
 - b. Density: 2.0 to 2.6 lb/cu. ft. (32 to 42 kg/cu. m) when tested according to ASTM D1622.
 - c. Compressive Strength: Minimum 20 psi (140 kPa) when tested according to ASTM D1621.
 - d. Shear Strength: 26 psi (179 kPa) when tested according to ASTM C273/C273M.
 6. Fire-Test-Response Characteristics: Class A according to ASTM E108.

7. Surface-Burning Characteristics: Flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E84.

B. Finishes:

1. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2.7 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

1. Closures: Provide sculptured closures at eaves and ridges, fabricated of same material as metal roof panels.
2. Clips: Manufacturer's standard, formed from steel sheet, designed to withstand negative-load requirements.
3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from steel sheet.
4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
6. Thermal Spacer Blocks: Where uninsulated metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide nominal 1-inch (25-mm) standoff; fabricated from extruded polystyrene.

- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.

1. Closures: Provide sculptured closures at eaves and rakes, fabricated of same material as metal wall panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum **1-inch- (25-mm-)** thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- D. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.024-inch (0.61-mm)** nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.
1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
 2. Opening Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.024-inch (0.61-mm)** nominal uncoated steel thickness, prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.
- E. Gutters: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.024-inch (0.61-mm)** nominal uncoated steel thickness, prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum **96-inch- (2438-mm-)** long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
1. Gutter Supports: Fabricated from same material and finish as gutters.
 2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.
- F. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.024-inch (0.61-mm)** nominal uncoated steel thickness, prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum **10-foot- (3-m-)** long sections, complete with formed elbows and offsets.
1. Mounting Straps: Fabricated from same material and finish as gutters.

2.8 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

1. Make shop connections by welding or by using high-strength bolts.
 2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
 3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
 4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.
 5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
1. Make shop connections by welding or by using non-high-strength bolts.
 2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.
- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before erection proceeds, survey elevations and locations of concrete bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
- C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written instructions and drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing 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. 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.
 - 3. 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.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
 - 1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.
 - a. Joint Type: Snug tightened or pretensioned as required by manufacturer.
- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
 - 1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 - 2. Locate and space wall girts to suit openings such as doors and windows.
 - 3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
- H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
 - 1. Tighten rod and cable bracing to avoid sag.
 - 2. Locate interior end-bay bracing only where indicated.

- I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 METAL PANEL INSTALLATION, GENERAL

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
 - 1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.
- D. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
 - a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
 - 2. Install metal panels perpendicular to structural supports unless otherwise indicated.
 - 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Locate metal panel splices over structural supports with end laps in alignment.
 - 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
- E. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
 - 1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
- F. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying

rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

- G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
 - 1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.5 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
 - 1. Install ridge caps as metal roof panel work proceeds.
 - 2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
 - 1. Install clips to supports with self-drilling or self-tapping fasteners.
 - 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 - 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
 - 4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
 - 5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Pre-drill panels for fasteners.
 - 6. Provide metal closures at peaks and rake edges each side of ridge caps.
- C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.
- D. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of **1/4 inch in 20 feet (6 mm in 6 m)** on slope and location lines and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.

3.6 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Predrill panels.
4. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.
5. Install screw fasteners in predrilled holes.
6. Install flashing and trim as metal wall panel work proceeds.
7. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
8. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
9. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Insulated Metal Wall Panels: Install insulated metal wall panels on exterior side of girts. Attach panels to supports at each panel joint using concealed clip and fasteners at maximum **42 inches (1067 mm)** o.c., spaced not more than manufacturer's recommendation. Fully engage tongue and groove of adjacent insulated metal wall panels.

1. Install clips to supports with self-tapping fasteners.
2. Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels as weather seal.

C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of **1/4 inch in 20 feet (6 mm in 6 m)**, noncumulative; level, plumb, and on location lines; and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.

3.7 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to

- form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 feet (3 m)** with no joints allowed within **24 inches (600 mm)** of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than **36 inches (914 mm)** o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with **1-1/2-inch (38-mm)** telescoping joints. Provide fasteners designed to hold downspouts securely **1 inch (25 mm)** away from walls; locate fasteners at top and bottom and at approximately **60 inches (1524 mm)** o.c. in between.
1. Provide elbows at base of downspouts to direct water away from building.
 2. Tie downspouts to underground drainage system indicated.

3.8 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.
- B. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- D. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 133419

SECTION 23 01 00 - OPERATION AND MAINTENANCE OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Sleeves.
 - 5. Escutcheons.
 - 6. Grout.
 - 7. Equipment installation requirements common to equipment sections.
 - 8. Concrete bases.
 - 9. Supports and anchorages.

1.2 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.

1.3 SUBMITTALS

- A. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

- B. 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.

- C. Electrical Characteristics for Mechanical 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.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 15 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.

2.2 JOINING MATERIALS

- A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

- E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

- F. Welding Filler Metals: Comply with AWS D10.12.

- G. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.

2.3 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. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Stainless steel. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- 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.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated and rough brass.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated and rough brass.

2.7 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 (34.5-MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 MECHANICAL DEMOLITION

- A. Refer to other specification sections for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.
- B. 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.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. 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.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve 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.
- O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve 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.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to specifications for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. 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," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. 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.

- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. 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.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. 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.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

- 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.

3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in specifications.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 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. Field Welding: Comply with AWS D1.1.

3.8 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.

3.9 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.

END OF SECTION 23 01 00

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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 general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.
- B. 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.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed 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. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. 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.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 05 13

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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 hangers and supports for mechanical system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Fiberglass pipe hangers.
 - 4. Metal framing systems.
 - 5. Fiberglass strut systems.
 - 6. Thermal-hanger shield inserts.
 - 7. Fastener systems.
 - 8. Pipe stands.
 - 9. Pipe positioning systems.
 - 10. Equipment supports.
- B. Related Sections include the following:
 - 1. Division 5 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-protection piping.
 - 3. Division 23 Section "Vibration and Seismic Controls for HVAC piping and equipment" for vibration isolation devices.
 - 4. Division 23 Section "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 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.

- C. Design seismic-restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Fiberglass pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Powder-actuated fastener systems.
 - 5. Pipe positioning systems.
- 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. Fiberglass strut systems. Include Product Data for components.
 - 4. Pipe stands. Include Product Data for components.
 - 5. Equipment supports.
- C. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."

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 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
 - 1. AAA Technology & Specialties Co., Inc.
 - 2. B-Line Systems, Inc.; a division of Cooper Industries.

3. Empire Industries, Inc.
4. ERICO/Michigan Hanger Co.
5. Globe Pipe Hanger Products, Inc.
6. Grinnell Corp.
7. National Pipe Hanger Corporation.
8. Piping Technology & Products, 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.

2.3 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.

2.4 FIBERGLASS PIPE HANGERS

- A. Clevis-Type, Fiberglass Pipe Hangers: Similar to MSS Type 1, steel pipe hanger except hanger is made of fiberglass and continuous-thread rod and nuts are made of polyurethane or stainless steel.

1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Champion Fiberglass, Inc.
 - c. Cope, T. J., Inc.; Tyco International, Ltd.
 - d. Seasafe, Inc.
 - e. Unistrut Corp.; Tyco International, Ltd.
 - f. Wesanco, Inc.

- B. Strap-Type, Fiberglass Pipe Hangers: Made of fiberglass loop with stainless-steel continuous-thread rod, nuts, and support hook.

1. Manufacturers:
 - a. Plasti-Fab, Inc.

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. B-Line Systems, Inc.; a division of Cooper Industries.
 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
 3. GS Metals Corp.
 4. Power-Strut Div.; Tyco International, Ltd.

5. Thomas & Betts Corporation.
 6. Tolco Inc.
 7. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.6 FIBERGLASS STRUT SYSTEMS

- A. Description: Shop- or field-fabricated pipe-support assembly, similar to MFMA-3, made of fiberglass channels and other components.
- B. Manufacturers:
1. B-Line Systems, Inc.; a division of Cooper Industries.
 2. Champion Fiberglass, Inc.
 3. Cope, T. J., Inc.; Tyco International Ltd.
 4. Seasafe, Inc.

2.7 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Manufacturers:
1. Carpenter & Paterson, Inc.
 2. ERICO/Michigan Hanger Co.
 3. PHS Industries, Inc.
 4. Pipe Shields, Inc.
 5. Rilco Manufacturing Company, Inc.
 6. Value Engineered Products, Inc.
- C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.8 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, 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. Hilti, Inc.
 - b. ITW Ramset/Red Head.
 - c. Masterset Fastening Systems, Inc.
 - d. MKT Fastening, LLC.
 - e. Powers Fasteners.

- B. Mechanical-Expansion Anchors: Insert-wedge-type stainless 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 Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head.
 - e. MKT Fastening, LLC.
 - f. Powers Fasteners.

2.9 PIPE STAND FABRICATION

- A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1. Manufacturers:
 - a. ERICO/Michigan Hanger Co.
 - b. MIRO Industries.

- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

1. Manufacturers:
 - a. MIRO Industries.

- D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Manufacturers:
 - a. ERICO/Michigan Hanger Co.
 - b. MIRO Industries.
 - c. Portable Pipe Hangers.

2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.

4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 1. Manufacturers:
 - a. Portable Pipe Hangers.
 2. Bases: One or more plastic.
 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.
 - F. Curb-Mounting-Type 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.

2.10 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Manufacturers:
 1. C & S Mfg. Corp.
 2. HOLDRITE Corp.; Hubbard Enterprises.
 3. Samco Stamping, Inc.

2.11 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.12 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 (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN 100 to DN 400), requiring up to 4 inches (100 mm) of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN 20 to DN 600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN 15 to DN 600), if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
 - 6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN 20 to DN 200).
 - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
 - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
 - 9. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).
 - 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN 10 to DN 200).
 - 11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN 10 to DN 80).
 - 12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.
 - 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.

16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN 65 to DN 900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
 17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN 65 to DN 500), from single rod if horizontal movement caused by expansion and contraction might occur.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN 50 to DN 600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN 50 to DN 750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.
- H. 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 (150 mm) for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) 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 (49 to 232 deg C) piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.

8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb (340 kg).
 - b. Medium (MSS Type 32): 1500 lb (680 kg).
 - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

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 structure.
- B. 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.
- C. Fiberglass Pipe Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled fiberglass struts.
- F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- G. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- H. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 7 Section "Roof Accessories" for curbs.
- I. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 15 Section "Plumbing Fixtures" for plumbing fixtures.
- J. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- K. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- L. Install hangers and supports to allow controlled thermal and seismic 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.
- M. Install lateral bracing with pipe hangers and supports to prevent swaying.
- N. 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 (DN 65) 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.
- O. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- P. 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.
- Q. Insulated Piping: Comply with the following:
 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 4. Shield Dimensions for Pipe: Not less than the following:

- a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 - d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
 - e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
5. Pipes NPS 8 (DN 200) and Larger: Include wood inserts.
 6. Insert Material: Length at least as long as protective shield.
 7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

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 (40 mm).

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.
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 23 05 29

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:
 - 1. Equipment nameplates.
 - 2. Equipment markers.
 - 3. Equipment signs.
 - 4. Access panel and door markers.
 - 5. Pipe markers.
 - 6. Duct markers.
 - 7. Valve tags.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME 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.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
 - 1. Data:
 - a. Manufacturer, product name, model number, and serial number.
 - b. Capacity, operating and power characteristics, and essential data.
 - c. Labels of tested compliances.
 - 2. Location: Accessible and visible.
 - 3. Fasteners: As required to mount on equipment.
- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
 - 1. Terminology: Match schedules as closely as possible.
 - 2. Data:

- C.
 - 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.
- 2. Size: 2-1/2 by 4 inches (64 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.
- D. 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. Data: Instructions for operation of equipment and for safety procedures.
 - 2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
 - 3. Thickness: 1/16 inch (1.6 mm), unless otherwise indicated.
 - 4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.
- E. Access Panel and Door Markers: 1/16-inch- (1.6-mm-) thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch (3.2-mm) center hole for attachment.
 - 1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
 - 1. Colors: Comply with ASME A13.1, unless otherwise indicated.
 - 2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
 - 3. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers extending 360 degrees around pipe at each location.
 - 4. Pipes with OD, Including Insulation, 6 Inches (150 mm) 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. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.
- C. Plastic Tape: Continuously printed, vinyl tape at least 3 mils (0.08 mm) thick with pressure-sensitive, permanent-type, self-adhesive back.
 - 1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): 3/4 inch (19 mm) minimum.
 - 2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches (150 mm) or Larger: 1-1/2 inches (38 mm) minimum.

2.3 DUCT IDENTIFICATION DEVICES

- A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers, with numbering scheme. Provide 5/32-inch (4-mm) hole for fastener.
 - 1. Material: 0.032-inch- (0.8-mm-) thick brass.
 - 2. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 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. Outdoor Rooftop Units and Energy Recovery Ventilators.
 - 2. Pumps and other hydronic accessories.
 - 3. Fans, filters, coils, louvers and balancing dampers.
 - 4. Variable air volume terminal units.
 - 5. Hot water heating coils.
 - 6. Finned tube radiation and cabinet unit heaters.
 - 7. Indoor fan coil units.
 - 8. Outdoor Heat Pumps.
- B. Install equipment markers or signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.
 - 1. Identify mechanical equipment with equipment markers in the following color codes:
 - a. Green: For cooling equipment and components.
 - b. Yellow: For heating equipment and components.
 - c. Orange: For combination cooling and heating equipment and components.
 - d. Brown: For energy-reclamation equipment and components.
 - 2. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm),

- and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
 4. Include signs for the following general categories of equipment:
 - a. Air handling units, chillers and boilers.
 - b. Meters, valves, gages, thermometers, and similar equipment.
 - c. Smoke vents, louvers and sound traps.
 - d. Fans, coils VAV boxes and balancing dampers.
 - e. Hydronic accessories and radiant heating equipment.
 - f. Tanks and pumps.
 - g. Strainers, filters, humidifiers, water treatment and similar equipment
- C. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
1. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Pretensioned pipe markers. Use size to ensure a tight fit.
 2. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 3/4 inch (19 mm) wide, lapped at least 1-1/2 inches (38 mm) 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 valve and control device.
 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.
 6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
 7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.4 DUCT IDENTIFICATION

- A. Install duct markers with permanent adhesive on air ducts in the following color codes:
1. Green: For cold-air supply ducts.
 2. Yellow: For hot-air supply ducts.
 3. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 4. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm),

and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

- B. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) 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; shutoff valves; 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. Valve-Tag Size and Shape:
 - a. Domestic Cold Water or Chilled Water: 1-1/2 inches (38 mm), round.
 - b. Domestic Hot Water or Hot Water Heating: 1-1/2 inches (38 mm), round.
 - c. Natural Gas: 1-1/2 inches (38 mm), round.
 - 2. Valve-Tag Color:
 - a. Domestic Cold Water or Chilled Water: Yellow.
 - b. Domestic Hot Water or Hot Water Heating: Yellow.
 - c. Natural Gas: Yellow.
 - 3. Letter Color:
 - a. Domestic Cold Water or Chilled Water: Black.
 - b. Domestic Hot Water or Hot Water Heating: Black.
 - c. Natural Gas: Black.

3.6 ADJUSTING AND CLEANING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.
- B. Clean faces of mechanical identification devices.

END OF SECTION 23 05 53

SECTION 23 08 00 - COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.
- B. Related Sections:
 - 1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

1.3 DEFINITIONS

- A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- B. CxA: Commissioning Authority.
- C. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.
- D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 ALLOWANCES

- A. Labor, instrumentation, tools, and equipment costs for technicians for the performance of commissioning testing are covered by the "Schedule of Allowances" Article in Division 01 Section "Allowances."

1.5 UNIT PRICES

- A. Commissioning testing allowance may be adjusted up or down by the "List of Unit Prices" Article in Division 01 Section "Unit Prices" when actual man-hours are computed at the end of commissioning testing.

1.6 CONTRACTOR'S RESPONSIBILITIES

- A. Perform commissioning tests at the direction of the CxA.

- B. Attend construction phase controls coordination meeting.
- C. Attend testing, adjusting, and balancing review and coordination meeting.
- D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
- E. Provide information requested by the CxA for final commissioning documentation.
- F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.7 CxA'S RESPONSIBILITIES

- A. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.
- B. Direct commissioning testing.
- C. Verify testing, adjusting, and balancing of Work are complete.
- D. Provide test data, inspection reports, and certificates in Systems Manual.

1.8 COMMISSIONING DOCUMENTATION

- A. Provide the following information to the CxA for inclusion in the commissioning plan:
 - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
 - 2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
 - 3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
 - 4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
 - 5. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.
 - 6. Test and inspection reports and certificates.
 - 7. Corrective action documents.
 - 8. Verification of testing, adjusting, and balancing reports.

1.9 SUBMITTALS

- A. Certificates of readiness.
- B. Certificates of completion of installation, prestart, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

- A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.
- D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- E. Inspect and verify the position of each device and interlock identified on checklists.
- F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
- G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 Testing AND BALANCING VERIFICATION

- A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.
- B. Notify the CxA at least 10 days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.
- C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.
 - 1. The CxA will notify testing and balancing Contractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.
 - 2. The testing and balancing Contractor shall use the same instruments (by model and serial number) that were used when original data were collected.
 - 3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
 - 4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.
- B. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
- D. The CxA along with the HVAC&R Contractor, testing and balancing Contractor, and HVAC&R Instrumentation and Control Contractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.
- E. Tests will be performed using design conditions whenever possible.
- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- G. The CxA may direct that set points be altered when simulating conditions is not practical.
- H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
- I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.
- J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

- A. Boiler Testing and Acceptance Procedures: Testing requirements are specified in Division 23 boiler Sections. Provide submittals, test data, inspector record, and boiler certification to the CxA.
- B. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls." Assist the CxA with preparation of testing plans.
- C. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in Division 23 piping Sections. HVAC&R Contractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
 2. Description of equipment for flushing operations.
 3. Minimum flushing water velocity.
 4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.
- D. Energy Supply System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of gas systems and equipment at the direction of the CxA. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.
- E. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chillers, cooling towers, refrigerant compressors and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.
- F. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, steam, and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.
- G. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.

END OF SECTION 23 08 00

SECTION 23 11 23 - FACILITY NATURAL GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes fuel gas piping within the building. Products include the following:
 - 1. Pipe, tube, fittings, and joining materials.
 - 2. Protective pipe and fitting coating.
 - 3. Piping specialties.
 - 4. Specialty valves.

1.2 PROJECT CONDITIONS

- A. Gas System Pressures: Two pressure ranges. Primary pressure is 2.0 psig (13.8 kPa) and is reduced to secondary pressure of 0.5 psig (3.45 kPa) or less.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

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. NFPA Standard: Comply with NFPA 54, "National Fuel Gas Code."

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. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Corrugated, Stainless-Steel Tubing Systems: Comply with AGA LC 1 and include the following:
 - 1. Tubing: Corrugated stainless steel with plastic jacket or coating.
 - 2. Fittings: Copper alloy with ends made to fit corrugated tubing. Include ends with threads according to ASME B1.20.1 if connection to threaded pipe or fittings is required.
 - 3. Striker Plates: Steel, designed to protect tubing from penetrations.
- C. Steel Pipe: ASTM A 53/A 53M; Type E or S; Grade B; black. 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. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
 - 4. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Class 125.
 - 5. Joint Compound and Tape: Suitable for natural gas.

2.3 PROTECTIVE COATING

- A. Furnish pipe and fittings with factory-applied, corrosion-resistant polyethylene coating for use in contact with materials that may corrode the pipe.
- B. All exterior piping shall be painted with corrosion-resistant paint with color selected by architect.

2.4 PIPING SPECIALTIES

- A. Flexible Connectors: ANSI Z21.24, copper alloy.
- B. Quick-Disconnect Devices: ANSI Z21.41, convenience outlets and matching plug connector.

2.5 SPECIALTY VALVES

- A. Valve End Connections: Threaded, according to ASME B1.20.1.
- B. Appliance Connector Valves: ANSI Z21.15 and CSA International listed.
- C. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig (13.8-kPa) minimum pressure rating.
- D. Gas Valves: ASME B16.33 and CSA International-listed bronze body and 125-psig (860-kPa) pressure rating.

- E. Automatic Gas Valves: ANSI Z21.21, with mechanical operator for actuation by appliance automatic shutoff device.
 - 1. Acceptable Manufacturers:
 - a. ASCO General Controls.
 - b. Eaton Corporation; Controls Div.
 - c. GPS Gas Protection Systems Inc.
 - d. Honeywell International Inc.
 - e. Johnson Controls.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Close equipment shutoff valves before turning off fuel gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section.

3.2 PIPING APPLICATIONS

- A. Use flanges, unions, transition, and special fittings in applications below, unless otherwise indicated.
- B. Fuel Gas Piping, 2 psig (13.8 kPa) or Less:
 - 1. NPS 1/2 (DN 15) and Smaller: NPS 3/4 (DN 20) steel pipe, malleable-iron threaded fittings, and threaded joints or Corrugated, stainless-steel tubing system and threaded joints.
 - 2. NPS 3/4 and NPS 1 (DN 20 and DN 25): Steel pipe, malleable-iron threaded fittings, and threaded joints or Corrugated, stainless-steel tubing system and threaded joints.
 - 3. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): Steel pipe, malleable-iron threaded fittings, and threaded joints.
 - 4. NPS 2-1/2 to NPS 6 (DN 65 to DN 150): Steel pipe, malleable-iron butt weld fittings, and welded joints.

3.3 VALVE APPLICATIONS

- A. Appliance Shutoff Valves for Pressure 0.5 psig (3.45 kPa) or Less: Appliance connector valve or gas stop.
- B. Appliance Shutoff Valves for Pressure 0.5 to 2 psig (3.45 to 13.8 kPa): Gas stop or gas valve.
- C. Piping Line Valves, NPS 2 (DN 50) and Smaller: Gas valve.
- D. Valves at Service Meter, NPS 2 (DN 50) and Smaller: Gas valve.

3.4 INSTALLATION

- A. Basic piping installation requirements and piping joint construction are specified in Division 23 Section "Operation and Maintenance of HVAC Systems."
- B. Install pressure gage upstream and downstream from each service pressure regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."
- C. Concealed Locations: Except as specified below, install concealed gas piping in airtight conduit constructed of Schedule 40, seamless, black steel pipe with welded joints. Vent conduit to outside and terminate with screened vent cap.
 - 1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves above ceilings.
 - 2. In Partitions: Do not install concealed piping in solid partitions. Protect tubing from physical damage when installed inside partitions or hollow walls.
 - 3. 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.
 - 4. 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.
- D. 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 (75 mm) long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.
- E. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings unless specifically shown to be exposed to view.
- F. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.
- G. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- H. Connect branch piping from top or side of horizontal piping.
- I. Install unions in pipes NPS 2 (DN 50) 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.
- J. Install corrugated, stainless-steel tubing system according to manufacturer's written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.
- K. Install strainer on inlet of each line pressure regulator and automatic operated valve.
- L. Install pressure gage upstream and downstream from each line pressure regulator. Pressure gages are specified in Division 15 Section "Meters and Gages."

- M. Install flanges on valves, specialties, and equipment having NPS 2-1/2 (DN 65) and larger connections.
- N. 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.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Pipe hanger and support devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
 - 2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
 - 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
- C. Install hangers for horizontal corrugated, stainless-steel tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): Maximum span, 48 inches (1219 mm); minimum rod size, 3/8 inch (10 mm).
 - 2. NPS 3/4 and NPS 1 (DN 20 and DN 25): Maximum span, 72 inches (1829 mm); minimum rod size, 3/8 inch (10 mm).
 - 3. Option: Support tubing from structure according to manufacturer's written instructions.

3.6 CONNECTIONS

- A. Install piping adjacent to appliances to allow service and maintenance. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches (1800 mm) of each appliance. Install union downstream from valve.

3.7 FIELD QUALITY CONTROL

- A. Test, inspect, and purge piping according to NFPA 54 and requirements of authorities having jurisdiction. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

END OF SECTION 23 11 23

SECTION 23 34 23 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. In-line centrifugal fans.

1.2 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 gages and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

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. Wiring Diagrams: Power, signal, and control wiring.
2. 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. Operation and maintenance data.

1.3 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. 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.

1.4 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. Belts: One set for each belt-driven unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraphs titles below introduce lists, the following requirements apply for product selection:
 - 1. Acceptable Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 IN-LINE CENTRIFUGAL FANS

- A. Description: In-line, belt-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.
 - 1. Acceptable Manufacturers:
 - a. Acme Engineering & Mfg. Corp.
 - b. Carnes Company HVAC.
 - c. Cook, Loren Company.
 - d. Greenheck Fan Corp.
 - e. Penn Ventilation Companies, Inc.
- B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- C. Direct-Driven Units: Motor encased in housing outside of airstream, factory wired to disconnect switch located on outside of fan housing.
- D. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- E. Accessories:
 - 1. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
 - 2. Companion Flanges: For inlet and outlet duct connections.
 - 3. Fan Guards: 1/2- by 1-inch (13- by 25-mm) mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
 - 4. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

2.3 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. Support units using spring isolators having a static deflection of 1 inch (25 mm). Vibration devices are specified in Division 23 Section "Mechanical Vibration."
- B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 7 for installation of roof curbs.
- C. Secure wall-mounting fans to wall with unit supplied equipment per manufacturer's installation requirements.
- D. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- E. Install units with clearances for service and maintenance.
- F. Label units according to requirements specified in Division 23 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 "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

- A. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

- C. Shut unit down and reconnect automatic temperature-control operators.
- D. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
- E. Replace fan and motor pulleys as required to achieve design airflow.
- F. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

END OF SECTION 23 34 23

SECTION 23 55 23 - FUEL-FIRED RADIANT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes gas-fired infrared and high-intensity radiant heaters.

1.2 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories.
- B. Shop Drawings: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.3 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.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace heat exchanger of fuel-fired radiant heater that fail in materials and workmanship within 5 years from date of Substantial Completion.

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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 TUBULAR INFRARED HEATERS

- A. Manufacturers:
1. Co Ray Vac
 2. Gordon Ray
 3. Reznor/Thomas & Betts.
 4. Roberts-Gordon, Inc.
 5. Solaronics, Inc.
- B. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.6, "Gas-Fired Infrared Heaters."
1. AGA Approval: Designed and certified by and bearing label of American Gas Association.
 2. Type of Gas: Designed and built to burn natural gas with characteristics same as those of gas available at Project site.
- C. Combustion Tubing: Stainless Steel with high-emissivity, high-temperature, corrosion-resistant external finish.
- D. Tubing Connections: Stainless-steel couplings or flared joints with stainless-steel draw bolts.
- E. Reflector: Polished aluminum, 97 percent minimum reflectivity, with end caps. Shape to control radiation from tubing for uniform intensity at floor level with 100 percent cutoff above centerline of tubing. Provide for rotating reflector or heater around a horizontal axis for minimum 30-deg ree (0.52-radian) tilt from vertical.
1. Reflector Extension Shields: Same material as reflectors, arranged for fixed connection to lower reflector lip and rigid support to provide 100 percent cutoff of direct radiation from tubing at angles greater than 30 deg rees (0.52 radians) from vertical.
 2. Include hanger kit.
- F. Burner Safety Controls:
1. Gas Control Valve: Single-stage, regulated redundant 24-V ac gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
 2. Blocked Vent Safety: Differential pressure switch in burner safety circuit to stop burner operation with high discharge or suction pressure.
 3. Control Panel Interlock: Stops burner if panel is open.
 4. Indicator Lights: Burner-on indicator light.
- G. Burner and Emitter Type: Gravity-vented power burner, with the following features:
1. Emitter Tube: Aluminized-steel tubing with sight glass for burner and pilot flame observation.
 2. Venting: Connector at exit end of emitter tubing for vent-pipe connection.
 - a. Vent Terminal: Vertical.
 3. Burner/Ignition: Power gas burner with electronic spark and electronic flame safety.
 4. Combustion-Air Connection: Duct connection for combustion air to be drawn directly from outside by burner fan.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install radiant heaters level and plumb.
- B. Install and connect gas-fired radiant heaters and associated fuel and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written installation instructions.
- C. Suspended Units: Suspend from substrate using chain hanger kits and building attachments.

3.2 CONNECTIONS

- A. Install piping adjacent to machine to allow service and maintenance.
- B. Gas Piping: Comply with applicable requirements in Division 23 Section "Fuel Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service. Provide AGA-approved flexible units.
- C. Connect vents according to Division 23 Section "Breechings, Chimneys, and Stacks."
- D. Electrical: Comply with applicable requirements in Electrical Specification Sections.
 - 1. Install electrical devices furnished with heaters but not specified to be factory mounted.
- E. Ground equipment according to Division 23 Section "Grounding and Bonding."

3.3 FIELD QUALITY CONTROL

- A. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Adjust burner and other unit components for optimum heating performance and efficiency.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fuel-fired radiant heaters. Refer to Division 1 Section

END OF SECTION 23 55 23

SECTION 26 00 10 - SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Supplemental requirements applicable to Work specified in Division 26.

1.2 REFERENCES

A. Abbreviations and Acronyms for Electrical Terms and Units of Measure:

1. 8PSJ or 8P8C: Miniature 8-position series jack, also called an 8-position 8-contact modular jack for some applications.
2. A: Ampere, unit of electrical current.
3. AC or ac: Alternating current.
4. AFCI: Arc-fault circuit interrupter.
5. AIC: Ampere interrupting capacity.
6. AL, Al, or ALUM: Aluminum.
7. ASD: Adjustable-speed drive.
8. ATS: Automatic transfer switch.
9. AWG: American wire gauge; see ASTM B258.
10. BAS: Building automation system.
11. BIL: Basic impulse insulation level.
12. BIM: Building information modeling.
13. CAD: Computer-aided design or drafting.
14. CATV: Community antenna television.
15. CB: Circuit breaker.
16. CO/ALR: Copper-aluminum, revised.
17. COPS: Critical operations power system.
18. CU or Cu: Copper.
19. CU-AL or AL-CU: Copper-aluminum.
20. dB: Decibel, a unitless logarithmic ratio of two electrical, acoustical, or optical power values.
21. dB(A-weighted) or dB(A): Decibel acoustical sound pressure level with A-weighting applied in accordance with IEC 61672-1.
22. dB(adjusted) or dBa: Decibel weighted absolute noise power with respect to 3.16 pW (minus 85 dBm).
23. dBm: Decibel absolute power with respect to 1 mW.
24. DC or dc: Direct current.
25. DDC: Direct digital control (HVAC).
26. EGC: Equipment grounding conductor.
27. EMF: Electromotive force.
28. EMI: Electromagnetic interference.
29. EPM: Electrical preventive maintenance.
30. EPS: Emergency power supply.
31. EPSS: Emergency power supply system.
32. ESS: Energy storage system.
33. EV: Electric vehicle.

34. EVPE: Electric vehicle power export equipment.
35. EVSE: Electric vehicle supply equipment.
36. fc: Footcandle, a unit of illuminance equal to one lumen per square foot.
37. FLC: Full-load current.
38. ft: Foot.
39. GEC: Grounding electrode conductor.
40. GFCI: Ground-fault circuit interrupter.
41. GFPE: Ground-fault protection of equipment.
42. GND: Ground.
43. HACR: Heating, air conditioning, and refrigeration.
44. HDPE: High-density polyethylene.
45. HP or hp: Horsepower.
46. HVAC: Heating, ventilating, and air conditioning.
47. Hz: Hertz.
48. IBT: Intersystem bonding termination.
49. inch: Inch. To avoid confusion, the abbreviation "in." is not used.
50. IP: Ingress protection rating (enclosures); Internet protocol (communications).
51. IR: Infrared.
52. IS: Intrinsically safe.
53. IT&R: Inspecting, testing, and repair.
54. ITE: Information technology equipment.
55. kAIC: Kiloampere interrupting capacity.
56. kcmil or MCM: One thousand circular mils.
57. kV: Kilovolt.
58. kVA: Kilovolt-ampere.
59. kVA_r or kVAR: Kilovolt-ampere reactive.
60. kW: Kilowatt.
61. kWh: Kilowatt-hour.
62. LAN: Local area network.
63. lb: Pound (weight).
64. LCD: Liquid-crystal display.
65. LCDI: Leakage-current detector-interrupter.
66. LED: Light-emitting diode.
67. LP-Gas: Liquefied petroleum gas.
68. LRC: Locked-rotor current.
69. MCC: Motor-control center.
70. MLO: Main lugs only.
71. MVA: Megavolt-ampere.
72. mW: Milliwatt.
73. MW: Megawatt.
74. MWh: Megawatt-hour.
75. NC: Normally closed.
76. NiCd: Nickel cadmium.
77. NO: Normally open.
78. OCPD: Overcurrent protective device.
79. PC: Personal computer.
80. PCS: Power conversion system.
81. PCU: Power-conditioning unit.
82. PF or pf: Power factor.
83. PHEV: Plug-in hybrid electric vehicle.
84. PLC: Programmable logic controller.
85. PLFA: Power-limited fire alarm.
86. PoE: Power over Ethernet.
87. PV: Photovoltaic.
88. PVC: Polyvinyl chloride.
89. pW: Picowatt.

90. RFI: Radio-frequency interference (electrical); Request for interpretation (contract).
91. RMS or rms: Root-mean-square.
92. RPM or rpm: Revolutions per minute.
93. SCADA: Supervisory control and data acquisition.
94. SCR: Silicon-controlled rectifier.
95. SPD: Surge protective device.
96. sq.: Square.
97. SWD: Switching duty.
98. TCP/IP: Transmission control protocol/Internet protocol.
99. TEFC: Totally enclosed fan-cooled.
100. TR: Tamper resistant.
101. TVSS: Transient voltage surge suppressor.
102. UL: Underwriters Laboratories, Inc. (standards) or UL LLC (services).
103. UL CCN: UL Category Control Number.
104. UPS: Uninterruptible power supply.
105. USB: Universal serial bus.
106. UV: Ultraviolet.
107. V: Volt, unit of electromotive force.
108. V(ac): Volt, alternating current.
109. V(dc): Volt, direct current.
110. VA: Volt-ampere, unit of complex electrical power.
111. VAR: Volt-ampere reactive, unit of reactive electrical power.
112. VFC: Variable-frequency controller.
113. VOM: Volt-ohm-multimeter.
114. VPN: Virtual private network.
115. VRLA: Valve-regulated lead acid.
116. W: Watt, unit of real electrical power.
117. Wh: Watt-hour, unit of electrical energy usage.
118. WPT: Wireless power transfer.
119. WPTE: Wireless power transfer equipment.
120. WR: Weather resistant.

B. Abbreviations and Acronyms for Electrical Raceway Types:

1. EMT: Electrical metallic tubing.
2. ENT: Electrical nonmetallic tubing.
3. EPEC: Electrical HDPE underground conduit.
4. EPEC-40: Schedule 40 electrical HDPE underground conduit.
5. EPEC-80: Schedule 80 electrical HDPE underground conduit.
6. ERMC: Electrical rigid metal conduit.
7. FMC: Flexible metal conduit.
8. FNMC: Flexible nonmetallic conduit. See LFNC.
9. HDPE: See EPEC.
10. IMC: Steel electrical intermediate metal conduit.
11. LFMC: Liquidtight flexible metal conduit.
12. LFNC: Liquidtight flexible nonmetallic conduit.
13. PVC: Rigid PVC conduit.
14. PVC-40: Schedule 40 rigid PVC conduit.
15. PVC-80: Schedule 80 rigid PVC Conduit.
16. PVC-A: Type A rigid PVC concrete-encased conduit.
17. PVC-EB: Type EB rigid PVC concrete-encased underground conduit.
18. RMC: See ERMC.

C. Abbreviations and Acronyms for Electrical Cable Types:

1. AC: Armored cable.
2. CATV: Coaxial general-purpose cable.
3. CATVP: Coaxial plenum cable.
4. CATVR: Coaxial riser cable.
5. CI: Circuit integrity cable.
6. CL2: Class 2 cable.
7. CL2P: Class 2 plenum cable.
8. CL2R: Class 2 riser cable.
9. CL2X: Class 2 cable, limited use.
10. CL3: Class 3 cable.
11. CL3P: Class 3 plenum cable.
12. CL3R: Class 3 riser cable.
13. CL3X: Class 3 cable, limited use.
14. CM: Communications general-purpose cable.
15. CMG: Communications general-purpose cable.
16. CMP: Communications plenum cable.
17. CMR: Communications riser cable.
18. CMUC: Under-carpet communications wire and cable.
19. CMX: Communications cable, limited use.
20. DG: Distributed generation cable.
21. FC: Flat cable.
22. FCC: Flat conductor cable.
23. FPL: Power-limited fire-alarm cable.
24. FPLP: Power-limited fire-alarm plenum cable.
25. FPLR: Power-limited fire-alarm riser cable.
26. IGS: Integrated gas spacer cable.
27. ITC: Instrumentation tray cable.
28. ITC-ER: Instrumentation tray cable, exposed run.
29. MC: Metal-clad cable.
30. MC-HL: Metal-clad cable, hazardous location.
31. MI: Mineral-insulated, metal-sheathed cable.
32. MTW: Moisture-, heat-, and oil-resistant thermoplastic cable (machine tool wiring).
33. MV: Medium-voltage cable.
34. NM: Nonmetallic sheathed cable.
35. NMC: Nonmetallic sheathed cable with corrosion-resistant nonmetallic jacket.
36. NMS: Nonmetallic sheathed cable with signaling, data, and communications conductors, plus power or control conductors.
37. NPLF: Non-power-limited fire-alarm circuit cable.
38. NPLFP: Non-power-limited fire-alarm circuit cable for environmental air spaces.
39. NPLFR: Non-power-limited fire-alarm circuit riser cable.
40. NUCC: Nonmetallic underground conduit with conductors.
41. OFC: Conductive optical fiber general-purpose cable.
42. OFCG: Conductive optical fiber general-purpose cable.
43. OFCP: Conductive optical fiber plenum cable.
44. OFCR: Conductive optical fiber riser cable.
45. OFN: Nonconductive optical fiber general-purpose cable.
46. OFNG: Nonconductive optical fiber general-purpose cable.
47. OFNP: Nonconductive optical fiber plenum cable.
48. OFNR: Nonconductive optical fiber riser cable.
49. P: Marine shipboard cable.
50. PLTC: Power-limited tray cable.
51. PLTC-ER: Power-limited tray cable, exposed run.
52. PV: Photovoltaic cable.
53. RHH: Thermoset rubber, heat-resistant cable (high heat).

54. RHW: Thermoset rubber, moisture-resistant cable.
55. SA: Silicone rubber cable.
56. SE: Service-entrance cable.
57. SER: Service-entrance cable, round.
58. SEU: Service-entrance cable, flat.
59. SIS: Thermoset cable for switchboard and switchgear wiring.
60. TBS: Thermoplastic cable with outer braid.
61. TC: Tray cable.
62. TC-ER: Tray cable, exposed run.
63. TC-ER-HL: Tray cable, exposed run, hazardous location.
64. THW: Thermoplastic, heat- and moisture-resistant cable.
65. THHN: Thermoplastic, heat-resistant cable with nylon jacket outer sheath.
66. THHW: Thermoplastic, heat- and moisture-resistant cable.
67. THWN: Thermoplastic, moisture- and heat-resistant cable with nylon jacket outer sheath.
68. TW: Thermoplastic, moisture-resistant cable.
69. UF: Underground feeder and branch-circuit cable.
70. USE: Underground service-entrance cable.
71. XHH: Cross-linked polyethylene, heat-resistant cable.
72. XHHW: Cross-linked polyethylene, heat- and moisture-resistant cable.

D. Definitions:

1. Basic Impulse Insulation Level: Reference insulation level expressed in impulse crest voltage with a standard wave not longer than 1.5 times 50 microseconds and 1.5 times 40 microseconds.
2. Communications Jack: A fixed connecting device designed for insertion of a communications cable plug.
3. Communications Outlet: One or more communications jacks, or cables and plugs, mounted in a box or ring, with a suitable protective cover.
4. Designated Seismic System: A system component that requires design in accordance with ASCE/SEI 7, Ch. 13 and for which the Component Importance Factor is greater than 1.0.
5. Direct Buried: Installed underground without encasement in concrete or other protective material.
6. Enclosure: The case or housing of an apparatus, or the fence or wall(s) surrounding an installation, to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage. Types of enclosures and enclosure covers include the following:
 - a. Cabinet: An enclosure that is designed for either surface mounting or flush mounting and is provided with a frame, mat, or trim in which a swinging door or doors are or can be hung.
 - b. Concrete Box: A box intended for use in poured concrete.
 - c. Conduit Body: A means for providing access to the interior of a conduit or tubing system through one or more removable covers at a junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
 - d. Conduit Box: A box having threaded openings or knockouts for conduit, EMT, or fittings.
 - e. Cutout Box: An enclosure designed for surface mounting that has swinging doors or covers secured directly to and telescoping with the walls of the enclosure.
 - f. Device Box: A box with provisions for mounting a wiring device directly to the box.
 - g. Extension Ring: A ring intended to extend the sides of an outlet box or device box to increase the box depth, volume, or both.
 - h. Floor Box: A box mounted in the floor intended for use with a floor box cover and other components to complete the floor box enclosure.

- i. Floor-Mounted Enclosure: A floor box and floor box cover assembly with means to mount in the floor that is sealed against the entrance of scrub water at the floor level.
 - j. Floor Nozzle: An enclosure used on a wiring system, intended primarily as a housing for a receptacle, provided with a means, such as a collar, for surface-mounting on a floor, which may or may not include a stem to support it above the floor level, and is sealed against the entrance of scrub water at the floor level.
 - k. Junction Box: A box with a blank cover that joins different runs of raceway or cable and provides space for connection and branching of the enclosed conductors.
 - l. Outlet Box: A box that provides access to a wiring system having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for the entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting an outlet box cover, but without provisions for mounting a wiring device directly to the box.
 - m. Pedestal Floor Box Cover: A floor box cover that, when installed as intended, provides a means for typically vertical or near-vertical mounting of receptacle outlets above the floor's finished surface.
 - n. Pull Box: A box with a blank cover that joins different runs of raceway and provides access for pulling or replacing the enclosed cables or conductors.
 - o. Raised-Floor Box: A floor box intended for use in raised floors.
 - p. Recessed Access Floor Box: A floor box with provisions for mounting wiring devices below the floor surface.
 - q. Recessed Access Floor Box Cover: A floor box cover with provisions for passage of cords to recessed wiring devices mounted within a recessed floor box.
 - r. Ring: A sleeve, which is not necessarily round, used for positioning a recessed wiring device flush with the plaster, concrete, drywall, or other wall surface.
 - s. Ring Cover: A box cover, with raised center portion to accommodate a specific wall or ceiling thickness, for mounting wiring devices or luminaires flush with the surface.
 - t. Termination Box: An enclosure designed for installation of termination base assemblies consisting of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors, or both.
7. Emergency Systems: Those systems legally required and classed as emergency by municipal, state, federal, or other codes, or by any governmental agency having jurisdiction that are designed to ensure continuity of lighting, electrical power, or both, to designated areas and equipment in the event of failure of the normal supply for safety to human life.
8. Essential Electrical Systems: Those systems designed to ensure continuity of electrical power to designated areas and functions of a healthcare facility during disruption of normal power sources, and also to minimize disruption within the internal wiring system. (healthcare facilities)
9. High-Performance Building: A building that integrates and optimizes on a life-cycle basis all major high-performance attributes, including energy conservation, environment, safety, security, durability, accessibility, cost-benefit, productivity, sustainability, functionality, and operational considerations.
10. Jacket: A continuous nonmetallic outer covering for conductors or cables.
11. Luminaire: A complete lighting unit consisting of a light source such as a lamp, together with the parts designed to position the light source and connect it to the power supply. It may also include parts to protect the light source or the ballast or to distribute the light.
12. Miniature 8-Position Series Jack (8PSJ): Also called an 8-position 8-contact (8P8C) modular jack. An unkeyed jack with up to eight contacts commonly used to terminate twisted-pair and multiconductor Ethernet cable. Shape and dimensions are specified by TIA-1096.

- a. Caution: An 8PSJ is not the same thing as an FCC "registered jack" RJ45S, now called a miniature 8-position keyed jack (8PKJ). Ethernet cable plugs do not have rejection keys. Many manufacturers and suppliers incorrectly use "RJ45" as a generic term to describe any 8-position series plug or jack whether it has a rejection key or not.
13. Mode: The terms "Active Mode," "Off Mode," and "Standby Mode" are used as defined in the Energy Independence and Security Act (EISA) of 2007.
14. Multi-Outlet Assembly: A type of surface, flush, or freestanding raceway designed to hold conductors, receptacles, and switches, assembled in the field or at the factory.
15. Plenum: A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.
16. Receptacle: A fixed connecting device arranged for insertion of a power cord plug. Also called a power jack.
17. Receptacle Outlet: One or more receptacles mounted in a box with a suitable protective cover.
18. Sheath: A continuous metallic covering for conductors or cables.
19. UL Category Control Number: An alphabetic or alphanumeric code used to identify product categories covered by UL's Listing, Classification, and Recognition Services.
20. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:
 - a. Control Voltage: Having electromotive force between any two conductors, or between a single conductor and ground, that is supplied from a battery or other Class 2 or Class 3 power-limited source.
 - b. Line Voltage: (1) (controls) Designed to operate using the supplied low-voltage power without transformation. (2) (transmission lines, transformers, SPDs) The line-to-line voltage of the supplying power system.
 - c. Extra-Low Voltage: Not having electromotive force between any two conductors, or between a single conductor and ground, exceeding 30 V(ac rms), 42 V(ac peak), or 60 V(dc).
 - d. Low Voltage: Having electromotive force between any two conductors, or between a single conductor and ground, that is rated above 30 V but not exceeding 1000 V.
 - e. Medium Voltage: Having electromotive force between any two conductors, or between a single conductor and ground, that is rated about 1 kV but not exceeding 69 kV.
 - f. High Voltage: (1) (circuits) Having electromotive force between any two conductors, or between a single conductor and ground, that is rated above 69 kV but not exceeding 230 kV. (2) (safety) Having sufficient electromotive force to inflict bodily harm or injury.

1.3 COORDINATION

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions:
 1. Notify Owner no fewer than seven days in advance of proposed interruption of electrical service.
 2. Do not proceed with interruption of electrical service without Owner's written permission.
 3. Coordinate interruption with systems impacted by outage including, but not limited to, the following:
 - a. Emergency lighting.

- B. Arrange to provide temporary electrical service or power in accordance with requirements specified in Division 01.

1.4 PREINSTALLATION MEETINGS

- A. Electrical Preconstruction Conference: Schedule conference with Architect and Owner, not later than 10 days after notice to proceed. Agenda topics include, but are not limited to, the following:
 - 1. Electrical installation schedule.
 - 2. Status of power system studies.
 - 3. Value analysis proposals and requests for substitution of electrical equipment.
 - 4. Utility work coordination and class of service requests.
 - 5. Commissioning activities.

1.5 SEQUENCING

- A. Conduct and submit results of power system studies before submitting Product Data and Shop Drawings for electrical equipment.

1.6 ACTION SUBMITTALS

- A. Coordination Drawings for Ceiling Areas: Where indicated on drawings, provide reflected ceiling plan(s), supplemented by sections and other details, drawn to scale, in accordance with Section 01 31 00 "Project Management and Coordination," on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Structural members to which equipment and suspension systems will be attached.
 - 3. Size and location of access panels on ceilings.
 - 4. Elevation, size, and route of sprinkler piping.
 - 5. Elevation, size, and route of plumbing piping.
 - 6. Elevation, size, and route of ductwork.
 - 7. Elevation, size, and route of conduit.
 - 8. Elevation and size of wall-mounted and ceiling-mounted equipment.
 - 9. Access panels.
 - 10. Sprinklers.
 - 11. Air inlets and outlets.
 - 12. Control modules.
 - 13. Luminaires.
 - 14. Communications devices.
 - 15. Speakers.
 - 16. Security devices.
 - 17. Indicate clear dimensions for maintenance access in front of equipment.
 - 18. Indicate dimensions of fully-open access doors.
- B. Coordination Drawings for Conduit Routing: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

1.7 INFORMATIONAL SUBMITTALS

- A. Electrical Installation Schedule: At preconstruction meeting, and periodically thereafter as dates change, provide schedule for electrical installation Work to Owner and Architect including, but not limited to, milestone dates for the following activities:
1. Submission of power system studies.
 2. Submission of specified coordination drawings.
 3. Submission of action submittals specified in Division 26.
 4. Orders placed for major electrical equipment.
 5. Arrival of major electrical equipment on-site.
 6. Preinstallation meetings specified in Division 26.
 7. Utility service outages.
 8. Utility service inspection and activation.
 9. Closing of walls and ceilings containing electrical Work.
 10. System startup, testing, and commissioning activities for major electrical equipment.
 11. System startup, testing, and commissioning activities for emergency lighting.
 12. System startup, testing, and commissioning activities for automation systems (lighting control system, etc.).
 13. Pouring of concrete housekeeping pads for electrical equipment and testing of concrete samples.
 14. Requests for special inspections.
 15. Requests for inspections by authorities having jurisdiction.
- B. Delegated Design Drawings for Structural Masonry Wall Penetrations: Where indicated on Drawings, provide reflected ceiling plan(s), supplemented by elevations, sections, and other details, drawn to scale, signed and sealed by a qualified structural professional engineer, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Location and dimensions of structural members supporting wall.
 2. Location and dimensions of columns near penetrations.
 3. Location and dimension of headers and lintels.
 4. Doors and windows near penetrations.
 5. Location and dimensions of penetrating cuts.
 6. Sprinkler piping and sleeves.
 7. Plumbing piping and sleeves.
 8. Ductwork and sleeves.
 9. Conduit and sleeves.
 10. Firestopping assemblies for rated penetrations.
 11. Structural supports for piping, ductwork, and conduit on both sides of wall.

1.8 CLOSEOUT SUBMITTALS

- A. Facility EPM Program Binders:
1. Complete Set: On approved online or cloud solution and USB media that is clearly and permanently labeled with attached placard on lanyard to prevent misplacement.
 2. Volumes 2 and 8: Reproducible hardcopy on archival quality, 28 lb (105 GSM), acid-free, bond paper.
- B. Operation and Maintenance Data:

1. Provide emergency, operation, and maintenance manuals for each system, equipment, and device installed on the project.
 2. Include the following information:
 - a. Manufacturer's operating specifications.
 - b. User's guides for software and hardware.
 - c. Schedule of maintenance material items recommended to be stored at Project site.
 - d. Detailed instructions covering operation under both normal and abnormal conditions.
 - e. List of load-current and overload-relay heaters with related motor nameplate data.
 - f. List of lamp types and photoelectric relays used on Project, with ANSI and manufacturers' codes.
 - g. Manufacturer's instructions for setting field-adjustable components.
 - h. Manufacturer's instructions for testing, adjusting, and reprogramming microprocessor controls.
- C. Software and Firmware Operational Documentation: Provide software and firmware operational documentation, including the following:
1. Software operating and upgrade manuals.
 2. Names, versions, and website addresses for locations of installed software.
 3. Device address list.
 4. Printout of software application and graphic screens.
 5. Testing and adjusting of panic and emergency power features.
 6. For lighting controls include the following:
 - a. Adjustments of scene preset controls, adjustable fade rates, and fade overrides.
 - b. Operation of adjustable zone controls.
- D. Software:
1. Program Software Backup: Provide username and password for approved online or cloud solution.
 2. Provide to Owner upgrades and unrestricted licenses for installed and backup software, including operating systems and programming tools required for operation and maintenance.

1.9 QUALIFICATIONS

- A. Electrical Professional Engineer: Professional engineer possessing active qualifications specified in Section 01 40 00 "Quality Requirements," with expertise in electrical engineering, including electrical power system modeling and analysis of electrical safety in accordance with NFPA 70E.
- B. Low-Voltage Electrical Testing and Inspecting Agency: Entities possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.
 1. On-site electrical testing supervisors must have documented certification and experience with testing electrical equipment in accordance with NETA testing standards.

PART 2 - PRODUCTS

2.1 SUBSTITUTION LIMITATIONS FOR ELECTRICAL EQUIPMENT

- A. Substitution requests for electrical equipment will be entertained under the following conditions:
 - 1. Substitution requests may be submitted for consideration prior to the Electrical Preconstruction Conference if accompanied by value analysis data indicating that substitution will comply with Project performance requirements while significantly increasing value for Owner throughout life of facility.
 - 2. Substitution requests may be submitted for consideration concurrently with submission of power system study reports when those reports indicate that substitution is necessary for safety of maintenance personnel and facility occupants.
 - 3. Contractor is responsible for sequencing and scheduling power system studies and electrical equipment procurement. After the Electrical Preconstruction Conference, insufficient lead time for electrical equipment delivery will not be considered a valid reason for substitution.

2.2 FACILITY ELECTRICAL PREVENTIVE MAINTENANCE (EPM) PROGRAM BINDERS

- A. Description: Set of binders containing operation and maintenance data for facility's electrical equipment.
- B. Applicable Standards:
 - 1. Regulatory Requirements: Comply with recommendations in NFPA 70B.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL WORK

- A. Unless more stringent requirements are specified in the Contract Documents or manufacturers' written instructions, comply with NFPA 70 and NECA NEIS 1 for installation of Work specified in Division 26. Consult Architect for resolution of conflicting requirements.

3.2 SYSTEM STARTUP

- A. Commissioning Activities:
 - 1. Engage the Lighting Controls Manufacture to perform commissioning of the lighting controls, as described on drawings.

3.3 FIELD QUALITY CONTROL

- A. Administrant for Low-Voltage Electrical Tests and Inspections:
 - 1. Engage qualified low-voltage electrical testing and inspecting agency to administer and perform tests and inspections.
 - 2. Administer and perform tests and inspections.

3.4 CLOSEOUT ACTIVITIES

A. Demonstration:

1. With assistance from factory-authorized service representatives, demonstrate to Owner's maintenance and clerical personnel how to operate the following systems and equipment:
 - a. Lighting control systems specified on the drawings.
2. Provide video recordings of demonstrations to Owner.

B. Training:

1. With assistance from factory-authorized service representatives, train Owner's maintenance personnel on the following topics:
 - a. How to operate normal and emergency electrical systems.
 - b. Electrical power safety fundamentals refresher including arc-flash hazard safety features of electrical power distribution equipment in facility, interpreting arc-flash warning labels, selecting appropriate personal protective equipment, and understanding significance of findings documented in study report specified in Section 26 05 73.19 "Arc-Flash Hazard Analysis."
 - c. How to adjust, operate, and maintain Lighting Control Systems and devices as specified on the drawings.
 - d. How to adjust, operate, and maintain Compact Emergency Lighting Inverter(s) as specified on the drawings.
2. Provide video recordings of training sessions to Owner.

END OF SECTION 26 00 10

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Copper building wire rated 600 V or less.
 - 2. Aluminum building wire rated 600 V or less.
 - 3. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
 - 1. Section 26 00 10 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpha Wire Company.
 - 2. Belden Inc.
 - 3. Cerro Wire LLC.
 - 4. Encore Wire Corporation.
 - 5. General Cable; Prysmian Group North America.
 - 6. Okonite Company (The).
 - 7. 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. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

- E. Conductor Insulation:
 - 1. Type THHN and Type THWN-2: Comply with UL 83.
 - 2. Type XHHW-2: Comply with UL 44.

2.2 ALUMINUM BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn aluminum current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpha Wire Company.
 - 2. Belden Inc.
 - 3. Cerro Wire LLC.
 - 4. Encore Wire Corporation.
 - 5. General Cable; Prysmian Group North America.
 - 6. Okonite Company (The).
 - 7. 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. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Aluminum, complying with ASTM B800 and ASTM B801.
- E. Conductor Insulation:
 - 1. Type THHN and Type THWN-2: Comply with UL 83.
 - 2. Type XHHW-2: Comply with UL 44.

2.3 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 3M Electrical Products.
 - 2. ABB, Electrification Products Division.
 - 3. AFC Cable Systems; Atkore International.
 - 4. Gardner Bender.
 - 5. Hubbell Incorporated, Power Systems.
 - 6. Ideal Industries, Inc.
 - 7. ILSCO.

8. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 9. Service Wire Co.
- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
1. Material: Copper.
 2. Type: Two hole with standard barrels.
 3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders:
1. Copper; stranded.
- B. Branch Circuits:
1. Copper, Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- C. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type XHHW-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.

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 26 05 33 "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 Section 26 05 29 "Hangers and Supports for Electrical Systems."

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-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inch (150 mm) of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "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 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

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 Section 07 84 13 "Penetration Firestopping."

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.
 - 2. Ground bonding common with lightning protection system.
 - 3. Foundation steel electrodes.
- C. Related Requirements:
 - 1. Section 26 00 10 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.
- B. Field quality-control reports.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: In addition to items specified in Section 26 00 10 "Supplemental Requirements for Electrical," include the following:
 - 1. Plans showing as-built, dimensioned locations of system described in "Field Quality Control" Article, including the following:
 - a. Test wells.
 - b. Ground rods.
 - 2. Instructions for periodic testing and inspection of grounding features at test wells based on NFPA 70B.
 - a. Tests must determine if ground-resistance or impedance values remain within specified maximums, and instructions must recommend corrective action if values do not.
 - b. Include recommended testing intervals.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- 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. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB, Electrification Products Division.
 - 2. Advanced Lightning Technology, Ltd.
 - 3. Burndy; Hubbell Incorporated, Construction and Energy.
 - 4. ERICO; nVent.
 - 5. Galvan Industries, Inc.; Electrical Products Division, LLC.
 - 6. Harger Lightning & Grounding.
 - 7. ILSCO.
 - 8. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - 9. Robbins Lightning, Inc.

2.3 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B3.
 - 2. Stranded Conductors: ASTM B8.
 - 3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch (41 mm) wide and 1/16 inch (1.6 mm) thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inch (6.3 by 100 mm) in cross section, with 9/32-inch (7.14 mm) holes spaced 1-1/8 inch (28 mm) apart. Stand-off insulators for mounting must comply with UL 891 for use in switchboards, 600 V and must be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

- C. Mechanical-Type Bus-Bar Connectors: Cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- F. Conduit Hubs: Mechanical type, terminal with threaded hub.
- G. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- H. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- I. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.
- J. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.
- K. Straps: Solid copper, copper lugs. Rated for 600 A.
- L. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal two-piece clamp.
- M. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- N. Water Pipe Clamps:
 - 1. Mechanical type, two pieces with stainless-steel bolts.
 - a. Material: Die-cast zinc alloy.
 - b. Listed for direct burial.
 - 2. U-bolt type with malleable-iron clamp and copper ground connector.

2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 ft. (19 mm by 3 m).

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Copper, stranded conductors.
- B. Underground Grounding Conductors: Install bare copper conductor, size as noted on drawings.
 - 1. Bury at least 30 inch (750 mm) below grade.
- C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inch (50 mm) minimum from wall, 6 inch (150 mm) above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors must be connected to the ground bus. Unless indicated otherwise on the drawings, install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

- A. Generator: Install grounding electrode(s) at the generator location. The electrode must be connected to the equipment grounding conductor and to the frame of the generator.

3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inch (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inch (50 mm) above to 6 inch (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.
- D. Pad-Mounted Transformers and Switches: Install four ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inch (150 mm) from the foundation.

3.5 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.6 FENCE GROUNDING

- A. Fence Grounding: Install at maximum intervals of 1500 ft. (450 m) except as follows:
 - 1. Fences within 100 ft. (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 ft. (225 m).
 - a. Gates and Other Fence Openings: Ground fence on each side of opening.
- B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 ft. (45 m) on each side of crossing.
- C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

3.7 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inch (50 mm) below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

3.8 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without 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.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
4. Prepare dimensioned Drawings locating each test well, 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.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Substations and Pad-Mounted Equipment: 5 ohms.

3. Manhole Grounds: 10 ohms.
- E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Support for conductors in vertical conduit.
4. Structural steel for fabricated supports and restraints.
5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
6. Fabricated metal equipment support assemblies.

B. Related Requirements:

1. Section 26 00 10 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified structural professional engineer to design hanger and support system.
- B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame Rating: Class 1.
 2. Self-extinguishing according to ASTM D635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32 inch (10 mm) diameter holes at a maximum of 8 inch (200 mm) on center in at least one surface.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Allied Tube & Conduit; Atkore International.
 - c. B-line; Eaton, Electrical Sector.
 - d. CADDY; nVent.
 - e. Gripple Inc.

- f. G-Strut.
 - g. Unistrut; Atkore International.
 - 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 3. Material for Channel, Fittings, and Accessories: Galvanized steel.
 - 4. Channel Width: Selected for applicable load criteria.
 - 5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs must have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body must be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
- 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti, Inc.
 - 2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 2. 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 where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) B-line; Eaton, Electrical Sector.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti, Inc.
 - 4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325 (Grade A325M).
 - 6. Toggle Bolts: Stainless steel springhead type.
 - 7. Hanger Rods: Threaded steel.

2.3 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 Section 05 50 00 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 SELECTION

- A. Comply with the following standards for selection and installation of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 - 1. NECA NEIS 101
- B. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceway and Boxes for Electrical Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and ERMC as required by NFPA 70. Minimum rod size must be 1/4 inch (6 mm) in diameter.
- E. 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 two-bolt conduit clamps.
- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2 inch (38 mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 INSTALLATION OF SUPPORTS

- A. Comply with NECA NEIS 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA NEIS 1, EMT may be supported by openings through structure members, in accordance with 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 must be weight of supported components plus 200 lb (90 kg).
- 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 inch (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inch (100 mm) thick.
 6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 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 racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 05 50 00 "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. Submit welding certificates.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type EMT-S raceways and elbows.
2. Type ERMC-S raceways, elbows, couplings, and nipples.
3. Type FMC-S and Type FMC-A raceways.
4. Type LFMC raceways.
5. Type PVC raceways and fittings.
6. Fittings for conduit, tubing, and cable.
7. Threaded metal joint compound.
8. Solvent cements.
9. Surface metal raceways and fittings.
10. Wireways and auxiliary gutters.
11. Metallic outlet boxes, device boxes, rings, and covers.
12. Termination boxes.
13. Cabinets, cutout boxes, junction boxes, and pull boxes.
14. Cover plates for device boxes.
15. Hoods for outlet boxes.

B. Related Requirements:

1. Section 26 00 10 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

PART 2 - PRODUCTS

2.1 TYPE EMT-S RACEWAYS AND ELBOWS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 797 and UL Category Control Number FJMX.

B. Steel Electrical Metal Tubing (EMT-S) and Elbows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; Atkore International.
 - b. Calconduit; Atkore International.
 - c. Emerson Electric Co.
 - d. Republic Conduit; Nucor Corporation, Nucor Tubular Products.
 - e. Topaz Lighting & Electric.

- f. Western Tube; Zekelman Industries.
2. Material: Steel.
3. Options:
 - a. Exterior Coating: Zinc.
 - b. Interior Coating: Zinc with organic top coating.
 - c. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.2 TYPE ERM-C-S RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

- A. Performance Criteria:
 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 2. General Characteristics: UL 6 and UL Category Control Number DYIX.
- B. Galvanized-Steel Electrical Rigid Metal Conduit (ERM-C-S-G), Elbows, Couplings, and Nipples:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; Atkore International.
 - b. Crouse-Hinds; Eaton, Electrical Sector.
 - c. Killark; Hubbell Incorporated, Construction and Energy.
 - d. Republic Conduit; Nucor Corporation, Nucor Tubular Products.
 - e. Topaz Lighting & Electric.
 - f. Western Tube; Zekelman Industries.
 2. Exterior Coating: Zinc.
 3. Options:
 - a. Interior Coating: Zinc with organic top coating.
 - b. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.3 TYPE FMC-S AND TYPE FMC-A RACEWAYS

- A. Performance Criteria:
 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 2. General Characteristics: UL 1 and UL Category Control Number DXUZ.
- B. Steel Flexible Metal Conduit (FMC-S):
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Electri-Flex Company.
 2. Material: Steel.
 3. Options:

- a. Minimum Trade Size: Metric designator 21 (trade size 3/4).

C. Aluminum Flexible Metal Conduit (FMC-A):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Electri-Flex Company.
2. Material: Aluminum.
3. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.4 TYPE LFMC RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 360 and UL Category Control Number DXHR.

B. Steel Liquidtight Flexible Metal Conduit (LFMC-S):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Anaconda Sealite; Anamet Electrical, Inc.
 - c. Electri-Flex Company.
2. Material: Steel.
3. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.5 TYPE PVC RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 651 and UL Category Control Number DZYR.

B. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Calconduit; Atkore International.
 - c. JM Eagle; J-M Manufacturing Co., Inc.

- d. NAPCO; Westlake Chemical Corp.
 - e. Opti-Com Manufacturing Network, Inc (OMNI).
- 2. Dimensional Specifications: Schedule 40.
 - 3. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Markings: For use with maximum 90 deg C wire.
- C. Schedule 80 Rigid PVC Conduit (PVC-80) and Fittings:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Calconduit; Atkore International.
 - c. JM Eagle; J-M Manufacturing Co., Inc.
 - d. Opti-Com Manufacturing Network, Inc (OMNI).
 - 2. Dimensional Specifications: Schedule 80.
 - 3. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Markings: For use with maximum 90 deg C wire. For directional boring applications.
- D. Type EB Rigid PVC Concrete-Encased Underground Conduit (PVC-EB) and Fittings:
- 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. JM Eagle; J-M Manufacturing Co., Inc.
 - 2. Dimensional Specifications: Type EB.
 - 3. Options:
 - a. Minimum Trade Size: Metric designator 53 (trade size 2).

2.6 FITTINGS FOR CONDUIT, TUBING, AND CABLE

- A. Performance Criteria:
- 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- B. Fittings for Type ERM, Type IMC, and Type PVC Raceways:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Crouse-Hinds; Eaton, Electrical Sector.
 - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. Konkore Fittings; Atkore International.

- e. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - f. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - g. Southwire Company.
- 2. General Characteristics: UL 514B and UL Category Control Number DWTT.
 - 3. Options:
 - a. Material: Steel.
 - b. Coupling Method: Compression coupling.
 - c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
 - d. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.
- C. Fittings for Type EMT Raceways:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Allied Tube & Conduit; Atkore International.
 - c. Calconduit; Atkore International.
 - d. Crouse-Hinds; Eaton, Electrical Sector.
 - e. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - f. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - g. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - h. Southwire Company.
 - 2. General Characteristics: UL 514B and UL Category Control Number FKAV.
 - 3. Options:
 - a. Material: Steel.
 - b. Coupling Method: Setscrew coupling. Setscrew couplings with only single screw per conduit are unacceptable.
 - c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
 - d. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.
- D. Fittings for Type FMC Raceways:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Fittings Corp. (AMFICO).
 - b. Liquid Tight Connector Co.
 - 2. General Characteristics: UL 514B and UL Category Control Number ILNR.

2.7 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT

- A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 2419 and UL Category Control Number FOIZ.

2.8 SOLVENT CEMENTS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: As recommended by conduit manufacturer in accordance with UL 514B and UL Category Control Number DWTT.

2.9 SURFACE METAL RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 5 and UL Category Control Number RJBT.

B. Surface Metal Raceways and Fittings with Metal Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MonoSystems, Inc.
 - b. Wiremold; Legrand North America, LLC.
2. Options:
 - a. Galvanized steel base with snap-on covers.
 - b. Manufacturer's standard enamel finish in color selected by Architect.
 - c. Wiring Channels: As noted on drawings. Multiple channels must be capable of housing a standard 20 to 30 A NEMA device flush within the raceway.

2.10 WIREWAYS AND AUXILIARY GUTTERS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 870 and UL Category Control Number ZOYX.

B. Metal Wireways and Auxiliary Gutters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. B-line; Eaton, Electrical Sector.
 - c. Hoffman; nVent.

- d. MonoSystems, Inc.
 - e. Square D; Schneider Electric USA.
2. Additional Characteristics:
- a. Fittings and Accessories: Include covers, 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.
 - b. Finish: Manufacturer's standard enamel finish.
3. Options:
- a. Degree of Protection: Type 1 unless otherwise indicated.
 - b. Wireway Covers: Hinged type unless otherwise indicated.

2.11 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Performance Criteria:

- 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- 2. General Characteristics: UL 514A and UL Category Control Number QCIT.

B. Metallic Outlet Boxes:

- 1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Crouse-Hinds; Eaton, Electrical Sector.
 - c. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.
 - d. MonoSystems, Inc.
 - e. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - f. Pass & Seymour; Legrand North America, LLC.
 - g. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - h. Spring City Electrical Manufacturing Company.
 - i. Topaz Lighting & Electric.
 - j. Wiremold; Legrand North America, LLC.
- 3. Options:
 - a. Material: Sheet steel for recessed boxes used at the building interior; Cast metal for recessed boxes used at the building exterior walls, as well as surface mounted boxes used both at the building interior and exterior.
 - b. Sheet Metal Depth: Minimum 2.5 inch (65 mm).

- c. Cast-Metal Depth: Minimum 2.4 inch (60.3 mm).
- d. Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing up to 50 lb (23 kg).
- e. Paddle Fan Outlet Boxes and Covers: Nonadjustable, designed for attachment of paddle fan weighing up to 70 lb (32 kg).

C. Metallic Conduit Bodies:

- 1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Crouse-Hinds; Eaton, Electrical Sector.
 - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. Killark; Hubbell Incorporated, Construction and Energy.
 - e. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - f. Pass & Seymour; Legrand North America, LLC.
 - g. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.

D. Metallic Device Boxes:

- 1. Description: Box with provisions for mounting wiring device directly to box.
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Arlington Industries, Inc.
 - c. Crouse-Hinds; Eaton, Electrical Sector.
 - d. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - e. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.
 - f. Killark; Hubbell Incorporated, Construction and Energy.
 - g. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - h. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - i. Topaz Lighting & Electric.
- 3. Options:
 - a. Material: Sheet steel for recessed boxes used at the building interior; Cast metal for recessed boxes used at the building exterior walls, as well as surface mounted boxes used both at the building interior and exterior.
 - b. Sheet Metal Depth: minimum 2.5 inch (65 mm).
 - c. Cast-Metal Depth: minimum 2.4 inch (60.3 mm).

E. Metallic Floor Boxes and Floor Box Covers:

- 1. Description: Box mounted in floor with floor box cover and other components to complete floor box enclosure.
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. ABB, Electrification Products Division.
- b. AFC Cable Systems; Atkore International.
- c. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
- d. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.
- e. Leviton Manufacturing Co., Inc.
- f. Pass & Seymour; Legrand North America, LLC.
- g. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
- h. Wiremold; Legrand North America, LLC.

2.12 TERMINATION BOXES

- A. Description: Enclosure for termination base consisting of lengths of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors or both.
- B. Performance Criteria:
 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 2. General Characteristics: UL 1773 and UL Category Control Number XCKT.
- C. Termination Boxes and Termination Bases for Installation on Line Side of Service Equipment:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. B-line; Eaton, Electrical Sector.
 - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. Erickson Electrical Equipment Company.
 - e. Hoffman; nVent.
 - f. Metron; Hubbell Incorporated, Commercial and Industrial.
 - g. Milbank Manufacturing Co.
 2. Additional Characteristics: Listed and labeled for installation on line side of service equipment.
- D. Termination Boxes and Termination Bases for Installation on Load Side of Service Equipment:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. B-line; Eaton, Electrical Sector.
 - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. Erickson Electrical Equipment Company.
 - e. Hoffman; nVent.
 - f. Metron; Hubbell Incorporated, Commercial and Industrial.
 - g. Milbank Manufacturing Co.
 2. Additional Characteristics: Listed and labeled for installation on load side of service equipment.

2.13 CABINETS, CUTOUT BOXES, JUNCTION BOXES, AND PULL BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics:
 - a. Non-Environmental Characteristics: UL 50.
 - b. Environmental Characteristics: UL 50E.

B. Indoor Sheet Metal Cabinets:

1. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. B-line; Eaton, Electrical Sector.
 - c. Crouse-Hinds; Eaton, Electrical Sector.
 - d. Erickson Electrical Equipment Company.
 - e. Hoffman; nVent.
 - f. Killark; Hubbell Incorporated, Construction and Energy.
 - g. Milbank Manufacturing Co.
 - h. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - i. Robroy Enclosures; Robroy Industries.
 - j. Siemens Industry, Inc., Building Technologies Division.
3. Additional Characteristics: UL Category Control Number CYIV.
4. Options:
 - a. Degree of Protection: Type 1.

C. Indoor Sheet Metal Cutout Boxes:

1. Description: Enclosure that has swinging doors or covers secured directly to and telescoping with walls of enclosure.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. B-line; Eaton, Electrical Sector.
 - c. Crouse-Hinds; Eaton, Electrical Sector.
 - d. Erickson Electrical Equipment Company.
 - e. Hoffman; nVent.
 - f. Killark; Hubbell Incorporated, Construction and Energy.
 - g. Milbank Manufacturing Co.
 - h. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - i. Robroy Enclosures; Robroy Industries.
 - j. Siemens Industry, Inc., Building Technologies Division.
3. Additional Characteristics: UL Category Control Number CYIV.

4. Options:
 - a. Degree of Protection: Type 1.
- D. Indoor Sheet Metal Junction and Pull Boxes:
 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. B-line; Eaton, Electrical Sector.
 - b. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - c. Hoffman; nVent.
 - d. Hubbell Industrial Controls; Hubbell Incorporated, Commercial and Industrial.
 - e. Milbank Manufacturing Co.
 - f. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - g. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - h. Spring City Electrical Manufacturing Company.
 - i. Square D; Schneider Electric USA.
 3. Additional Characteristics: UL Category Control Number BGUZ.
 4. Options:
 - a. Degree of Protection: Type 1.
- E. Indoor Cast-Metal Junction and Pull Boxes:
 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adalet.
 - b. Crouse-Hinds; Eaton, Electrical Sector.
 - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 3. Additional Characteristics: UL Category Control Number BGUZ.
 4. Options:
 - a. Degree of Protection: Type 12.
- F. Outdoor Sheet Metal Cabinets:
 1. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Adalet.
 - c. B-line; Eaton, Electrical Sector.

- d. Crouse-Hinds; Eaton, Electrical Sector.
 - e. Erickson Electrical Equipment Company.
 - f. Hoffman; nVent.
 - g. Killark; Hubbell Incorporated, Construction and Energy.
 - h. Milbank Manufacturing Co.
 - i. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - j. Robroy Enclosures; Robroy Industries.
 - k. Siemens Industry, Inc., Building Technologies Division.
3. Additional Characteristics: UL Category Control Number CYIV.
 - a. Options:
 - b. Degree of Protection: Type 3R.
- G. Outdoor Sheet Metal Cutout Boxes:
1. Description: Enclosure that has swinging doors or covers secured directly to and telescoping with walls of enclosure.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Adalet.
 - c. B-line; Eaton, Electrical Sector.
 - d. Crouse-Hinds; Eaton, Electrical Sector.
 - e. Erickson Electrical Equipment Company.
 - f. Hoffman; nVent.
 - g. Killark; Hubbell Incorporated, Construction and Energy.
 - h. Milbank Manufacturing Co.
 - i. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - j. Robroy Enclosures; Robroy Industries.
 - k. Siemens Industry, Inc., Building Technologies Division.
 3. Additional Characteristics: UL Category Control Number CYIV.
 - a. Options:
 - b. Degree of Protection: Type 3R.
- H. Outdoor Sheet Metal Junction and Pull Boxes:
1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adalet.
 - b. B-line; Eaton, Electrical Sector.
 - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. Hoffman; nVent.
 - e. Hubbell Industrial Controls; Hubbell Incorporated, Commercial and Industrial.
 - f. Milbank Manufacturing Co.
 - g. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - h. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.

- i. Spring City Electrical Manufacturing Company.
 - j. Square D; Schneider Electric USA.
3. Additional Characteristics: UL Category Control Number BGUZ.
- a. Options:
 - b. Degree of Protection: Type 4.
- I. Outdoor Cast-Metal Junction and Pull Boxes:
- 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adalet.
 - b. Crouse-Hinds; Eaton, Electrical Sector.
 - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - 3. Additional Characteristics: UL Category Control Number BGUZ.
 - 4. Options:
 - a. Degree of Protection: Type 4.

2.14 COVER PLATES FOR DEVICES BOXES

- A. Performance Criteria:
- 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics:
 - a. Reference Standards: UL 514D and UL Category Control Numbers QCIT and QCMZ.
 - b. Wallplate-Securing Screws: Metal with head color to match wallplate finish.
- B. Metallic Cover Plates for Device Boxes:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
 - c. Crouse-Hinds; Eaton, Electrical Sector.
 - d. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - e. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.
 - f. Intermatic, Inc.
 - g. Leviton Manufacturing Co., Inc.
 - h. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - i. Pass & Seymour; Legrand North America, LLC.
 - j. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - k. Topaz Lighting & Electric.
 - l. Wiremold; Legrand North America, LLC.

2. Options:
 - a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
 - b. Wallplate Material: 0.032 inch (0.8 mm) thick Type 302/304 non-magnetic stainless steel with brushed finish.

2.15 HOODS FOR OUTLET BOXES

- A. Performance Criteria:
 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 2. General Characteristics:
 - a. Reference Standards:
 - 1) UL 514D and UL Category Control Numbers QCIT and QCMZ.
 - 2) Receptacle, hood, cover plate, gaskets, and seals comply with UL 498 Supplement SA when mated with box or enclosure complying with UL 514A, UL 514C, or UL 50E.
 3. Mounts to box using fasteners different from wiring device.
- B. Extra-Duty, While-in-Use Hoods for Outlet Boxes:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Allied Tube & Conduit; Atkore International.
 - c. Arlington Industries, Inc.
 - d. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
 - e. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - f. Intermatic, Inc.
 - g. Leviton Manufacturing Co., Inc.
 2. Additional Characteristics: Marked "Extra-Duty" in accordance with UL 514D.
 3. Options:
 - a. Provides gray, weatherproof, "while-in-use" cover.

PART 3 - EXECUTION

3.1 SELECTION OF RACEWAYS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.
- B. Outdoors:

1. Exposed and Subject to Severe Physical Damage: ERM C.
2. Exposed and Subject to Physical Damage: ERM C or Corrosion-resistant EMT.
 - a. Locations less than 2.5 m (8 ft) above finished floor.
3. Exposed and Not Subject to Physical Damage: ERM C or Corrosion-resistant EMT.
4. Concealed Aboveground: ERM C or EMT.
5. Direct Buried: PVC-80.
6. Concrete Encased Not in Trench: PVC-80.
7. Concrete Encased in Trench: PVC-80 or PVC-EB.
8. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

C. Indoors:

1. Hazardous Classified Locations: ERM C.
2. Exposed and Subject to Severe Physical Damage: ERM C. Subject to severe physical damage includes the following locations:
 - a. Loading docks.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums.
3. Exposed and Subject to Physical Damage: EMT. Subject to physical damage includes the following locations:
 - a. Locations less than 2.5 m (8 ft) above finished floor.
 - b. Stub-ups to above suspended ceilings.
4. Exposed and Not Subject to Physical Damage: EMT.
5. Concealed in Ceilings and Interior Walls and Partitions: EMT.
6. Damp or Wet Locations: Corrosion-resistant EMT.
7. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC.

D. Raceway Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.

1. ERM C and IMC: Provide threaded type fittings unless otherwise indicated.

3.2 SELECTION OF BOXES AND ENCLOSURES

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.

B. Degree of Protection:

1. Outdoors:
 - a. Type 3R unless otherwise indicated.
 - b. Locations Exposed to Hosedown: Type 4.
 - c. Locations Subject to Potential Flooding: Type 6P.

- d. Locations Aboveground Where Mechanism Must Operate When Ice Covered: Type 3S.
 - e. Locations in-Ground or Exposed to Corrosive Agents: Type 4X.
 - f. Locations in-Ground or Exposed to Corrosive Agents Where Mechanism Must Operate When Ice Covered: Type 3SX.
2. Indoors:
- a. Type 1 unless otherwise indicated.
 - b. Damp or Dusty Locations: Type 12.
 - c. Surface Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12.
 - d. Flush Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12.
 - e. Locations Exposed to Airborne Dust, Lint, Fibers, or Flyings: Type 4.
 - f. Locations Exposed to Hosedown: Type 4.
 - g. Locations Exposed to Brief Submersion: Type 6.
 - h. Locations Exposed to Prolonged Submersion: Type 6P.
 - i. Locations Exposed to Corrosive Agents: Type 4X.
 - j. Locations Exposed to Spraying Oil or Coolants: Type 13.
- C. Exposed Boxes Installed Less Than 2.5 m (8 ft) Above Floor:
1. Provide cast-metal boxes. Boxes with knockouts or unprotected openings are prohibited.
 2. Provide exposed cover. Flat covers with angled mounting slots or knockouts are prohibited.

3.3 INSTALLATION OF RACEWAYS

- A. Installation Standards:
1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Architect for resolution of conflicting requirements.
 2. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
 3. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.
 4. Comply with NECA NEIS 101 for installation of steel raceways.
 5. Comply with NECA NEIS 102 for installation of aluminum raceways.
 6. Comply with NECA NEIS 111 for installation of nonmetallic raceways.
 7. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
 8. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to metric designator 35 (trade size 1-1/4) and insulated throat metal bushings on metric designator 41 (trade size 1-1/2) and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
 9. Raceway Terminations at Locations Subject to Moisture or Vibration:
 - a. Provide insulating bushings to protect conductors, including conductors smaller than No. 4 AWG..

B. General Requirements for Installation of Raceways:

1. Complete raceway installation before starting conductor installation.
2. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft (0.6 m) above finished floor.
3. Install no more than equivalent of three 90-degree bends in conduit run. Support within 12 inch (300 mm) of changes in direction.
4. Make bends in raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
5. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
6. Support conduit within 12 inch (300 mm) of enclosures to which attached.
7. Install raceway sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings in accordance with NFPA 70.
8. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of raceways at the following points:
 - a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - b. Where an underground service raceway enters a building or structure.
 - c. Conduit extending from interior to exterior of building.
 - d. Conduit extending into pressurized duct and equipment.
 - e. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
 - f. Where otherwise required by NFPA 70.
9. Do not install raceways or electrical items on "explosion-relief" walls or rotating equipment.
10. Do not install conduits within 2 inch (50 mm) of the bottom side of a metal deck roof.
11. Keep raceways at least 6 inch (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
12. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
13. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb (90 kg) tensile strength. Leave at least 12 inch (300 mm) of slack at both ends of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

C. Requirements for Installation of Specific Raceway Types:

1. Types ERM and IMC:
 - a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
2. Types FMC and LFMC:

- a. Comply with NEMA RV 3. Provide a maximum of 72 inch (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
3. Type PVC:
 - a. Do not install Type PVC conduit where ambient temperature exceeds 122 deg F (50 deg C). Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete encasement, where 90 deg C conductors are permitted. Note that Type PVC conduit is PROHIBITED from use inside the building, above grade, or in any exposed installation locations.
 - b. Comply with manufacturer's written instructions for solvent welding and fittings.
- D. Raceways Embedded in Slabs:
1. Run raceways larger than metric designator 27 (trade size 1) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place raceway close to slab support. Secure raceways to reinforcement at maximum 10 ft (3 m) intervals.
 2. Arrange raceways to cross building expansion joints with expansion fittings at right angles to the joint.
 3. Arrange raceways to ensure that each is surrounded by a minimum of 1 inch (25 mm) of concrete without voids.
 4. Do not embed threadless fittings in concrete unless locations have been specifically approved by Architect.
 5. Change from PVC-80 to ERMC before rising above floor.
- E. Stub-ups to Above Recessed Ceilings:
1. Provide EMT, IMC, or ERMC for raceways.
 2. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- F. Raceway Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.
1. EMT: Provide setscrew, steel fittings. Comply with NEMA FB 2.10.
 2. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.
- G. Expansion-Joint Fittings:
1. Install in runs of aboveground ERMC and EMT conduit that are located where environmental temperature change may exceed 100 deg F (55 deg C) and that have straight-run length that exceeds 100 ft (30 m).
 2. Install type and quantity of fittings that accommodate temperature change listed for the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - d. Attics: 135 deg F (75 deg C) temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
4. Install expansion fittings at locations where conduits cross building or structure expansion joints.
5. Install expansion-joint fitting with position, mounting, and piston setting selected in accordance with manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

H. Raceways Penetrating Rooms or Walls with Acoustical Requirements:

1. Seal raceway openings on both sides of rooms or walls with acoustically rated putty or firestopping.

3.4 INSTALLATION OF SURFACE RACEWAYS

- A. Install surface raceways only where indicated on Drawings.
- B. Install surface raceway with a minimum 2 inch (50 mm) radius control at bend points.
- C. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inch (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway in accordance with manufacturer's written instructions. Tape and glue are unacceptable support methods.

3.5 INSTALLATION OF BOXES AND ENCLOSURES

- A. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
- B. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- C. 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. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
- D. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- E. Locate boxes so that cover or plate will not span different building finishes.
- F. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
- G. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
- H. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
- I. Set metal floor boxes level and flush with finished floor surface.

- J. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.
- K. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
- L. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:
 - 1. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
 - 2. Provide gaskets for wallplates and covers.

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

3.8 CLEANING

- A. Boxes: Remove construction dust and debris from device boxes, outlet boxes, and floor-mounted enclosures before installing wallplates, covers, and hoods.

END OF SECTION 26 05 33

SECTION 26 05 44 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Round sleeves.
2. Rectangular sleeves.
3. Sleeve seal systems.
4. Grout.
5. Pourable sealants.
6. Foam sealants.

B. Related Requirements:

1. Section 26 00 10 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

PART 2 - PRODUCTS

2.1 ROUND SLEEVES

A. Wall Sleeves, Steel:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, LLC.
 - b. CCI Piping Systems.
 - c. Flexicraft Industries.
2. Description: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.

B. Sheet Metal Sleeves, Galvanized Steel, Round:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Benefast.
2. Description: Galvanized-steel sheet; thickness not less than 0.0239 inch (0.6 mm); round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.2 RECTANGULAR SLEEVES

- A. Sheet Metal Sleeves, Galvanized Steel, Rectangular:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Abesco Fire LLC.
 - b. Specified Technologies, Inc.
 2. Description:
 - a. Material: Galvanized sheet steel.
 - b. Minimum Metal Thickness:
 - 1) For sleeve cross-section rectangle perimeter less than 50 inch (1270 mm) and with no side larger than 16 inch (400 mm), thickness must be 0.052 inch (1.3 mm).
 - 2) For sleeve cross-section rectangle perimeter not less than 50 inch (1270 mm) or with one or more sides larger than 16 inch (400 mm), thickness must be 0.138 inch (3.5 mm).

2.3 SLEEVE SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
 2. BWM Company.
 3. CALPICO, Inc.
 4. Flexicraft Industries.
 5. Metraflex Company (The).
 6. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable or between raceway and cable.
1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 2. Pressure Plates: Carbon steel.
 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
 2. Design Mix: 5000 psi (34.5 MPa), 28-day compressive strength.
 3. Packaging: Premixed and factory packaged.

2.5 POURABLE SEALANTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Carlisle SynTec Incorporated.
 - 2. GAF.
- B. Description: Single-component, neutral-curing elastomeric sealants of grade indicated below.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

2.6 FOAM SEALANTS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Dow Chemical Company (The).
- B. Description: Multicomponent, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam. Foam expansion must not damage cables or crack penetrated structure.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - b. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 92 00 "Joint Sealants."
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4 inch (6.4 mm) annular clear space between sleeve and raceway or cable, unless sleeve seal system is to be installed or seismic criteria require different clearance.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for wall assemblies.
- C. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- D. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seal systems. Size sleeves to allow for 1 inch (25 mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- E. Underground, Exterior-Wall and Floor Penetrations:
1. Install steel pipe sleeves with integral waterstops. Size sleeves to allow for 1 inch (25 mm) annular clear space between raceway or cable and sleeve for installing sleeve seal system. Install sleeve during construction of floor or wall.
 2. Install steel pipe sleeves. Size sleeves to allow for 1 inch (25 mm) annular clear space between raceway or cable and sleeve for installing sleeve seal system. Grout sleeve into wall or floor opening.

3.2 INSTALLATION OF RECTANGULAR SLEEVES AND SLEEVE SEALS

- A. Install sleeves in existing walls without compromising structural integrity of walls. Do not cut structural elements without reinforcing the wall to maintain the designed weight bearing and wall stiffness.
- B. Install conduits and cable with no crossings within the sleeve.
- C. Fill opening around conduits and cables with expanding foam without leaving voids.
- D. Provide metal sheet covering at both wall surfaces and finish to match surrounding surfaces. Metal sheet must be same material as sleeve.

3.3 INSTALLATION OF SLEEVE SEAL SYSTEMS

- A. Install sleeve seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 26 05 44

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

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. Color and legend requirements for raceways, conductors, and warning labels and signs.
 - 2. Labels.
 - 3. Tapes and stencils.
 - 4. Signs.
 - 5. Cable ties.
 - 6. Paint for identification.
 - 7. Fasteners for labels and signs.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Comply with Section 26 05 73.19 "Arc-Flash Hazard Analysis" requirements for arc-flash warning labels.
- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- G. 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 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
 2. Legend: Indicate voltage.
- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 3. Color for Neutral: White.
 4. Color for Equipment Grounds: Green.
 5. Colors for Isolated Grounds: Green two or more yellow stripes.
- C. Warning Label Colors:
1. Identify system voltage with black letters on an orange background.
- D. Warning labels and signs shall include, but are not limited to, the following legends:
1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
 2. Arc-Flash Hazard Labels.
- E. Equipment Identification Labels:
1. Black letters on a white field.

2.3 LABELS

- A. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, polyester flexible label with acrylic pressure-sensitive adhesive.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Brother International Corporation.
 - c. emedco.
 - d. Grafoplast Wire Markers.
 - e. Ideal Industries, Inc.
 - f. LEM Products Inc.
 - g. Marking Services, Inc.
 - h. Panduit Corp.
 2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
 3. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

- B. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Brother International Corporation.
 - c. emedco.
 - d. Grafolplast Wire Markers.
 - e. Ideal Industries, Inc.
 - f. LEM Products Inc.
 - g. Marking Services, Inc.
 - h. Panduit Corp.
 - 2. Minimum Nominal Size:
 - a. 1-1/2 by 6 inches (37 by 150 mm) for raceway and conductors.
 - b. 3-1/2 by 5 inches (76 by 127 mm) for equipment.
 - c. As required by authorities having jurisdiction.

2.4 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton Industries, LP.
 - b. Champion America.
 - c. HellermannTyton.
 - d. Ideal Industries, Inc.
 - e. Marking Services, Inc.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. emedco.
- C. Floor Marking Tape: 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Carlton Industries, LP.

D. Underground-Line Warning Tape:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Brimar Industries, Inc.
 - c. Ideal Industries, Inc.
 - d. LEM Products Inc.
 - e. Marking Services, Inc.
 - f. Reef Industries, Inc.
2. Tape:
 - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
3. Color and Printing:
 - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
 - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
 - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".
4. Tag: Type ID:
 - a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - b. Width: 3 inches (75 mm).
 - c. Overall Thickness: 5 mils (0.125 mm).
 - d. Foil Core Thickness: 0.35 mil (0.00889 mm).
 - e. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
 - f. Tensile according to ASTM D882: 70 lbf (311.3 N) and 4600 psi (31.7 MPa).

2.5 SIGNS

A. Laminated Acrylic or Melamine Plastic Signs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. emedco.
2. Engraved legend.

3. Thickness:
 - a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
 - b. For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.
 - c. Engraved legend with black letters on white face.
 - d. Punched or drilled for mechanical fasteners with 1/4-inch (6.4-mm) grommets in corners for mounting.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 CABLE TIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. HellermannTyton.
 2. Ideal Industries, Inc.
 3. Marking Services, Inc.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 1. Minimum Width: 3/16 inch (5 mm).
 2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D638: 12,000 psi (82.7 MPa).
 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 4. Color: Black.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.

- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.
- H. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- I. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- J. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- L. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
- M. Self-Adhesive Wraparound Labels: Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
- N. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
 - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- O. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- P. Underground Line Warning Tape:
 - 1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
 - 2. Limit use of underground-line warning tape to direct-buried cables.

3. Install underground-line warning tape for direct-buried cables and cables in raceways.

Q. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.

R. Cable Ties: UV-stabilized nylon.

3.2 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.
 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- D. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
 1. "EMERGENCY POWER."
- E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels to identify the phase.
 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels with the conductor or cable designation, origin, and destination.
- G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive wraparound labels with the conductor designation.
- H. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- I. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- J. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- K. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- L. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- M. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive equipment labels.
 1. Apply to exterior of door, cover, or other access.
- N. Arc Flash Warning Labeling: Self-adhesive labels.
- O. Operating Instruction Signs: Laminated acrylic or melamine plastic signs.
- P. Equipment Identification Labels:
 1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
 2. Outdoor Equipment: Laminated acrylic or melamine sign.

END OF SECTION 26 05 53

SECTION 26 05 73.13 - SHORT-CIRCUIT STUDIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. For computer software program to be used for studies.
 - 2. Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.
 - a. Short-circuit study input data, including completed computer program input data sheets.
 - b. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.
 - 1) Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
 - 2) Revised one-line diagram, reflecting field investigation results and results of short-circuit study.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
 - 1. For Power Systems Analysis Software Developer.
 - 2. For Power System Analysis Specialist.
 - 3. For Field Adjusting Agency.
- B. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

- B. Software algorithms shall comply with requirements of standards and guides specified in this Section.
- C. Manual calculations are unacceptable.
 - 1. Power System Analysis Software Qualifications: Computer program shall be designed to perform short-circuit studies or have a function, component, or add-on module designed to perform short-circuit studies.
 - 2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- D. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- E. Short-Circuit Study Certification: Short-Circuit Study Report shall be signed and sealed by Power Systems Analysis Specialist.
- F. Power Systems Analysis Companies: The Study shall be performed by one of the following companies, as a sub-contractor to the bidding Electrical Contractor. Companies other than those listed below will be Rejected for non-compliance.
 - 1. Utilities Instrumentation Services (UIS)
 - 2. Power Factor Engineering, LLC
 - 3. Northern Electrical Testing
 - 4. Schneider Electric (Square-D) (as part of the new distribution equipment).
 - 5. Eaton Power Systems (as part of the new distribution equipment).
 - 6. Siemens Power Systems (as part of the new distribution equipment).
- G. Field Adjusting Agency Qualifications:
 - 1. Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
 - 2. A member company of NETA.
 - 3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. EDSA Micro Corporation.
 - 2. SKM Systems Analysis, Inc.
- B. Comply with IEEE 399 and IEEE 551.
 - 1. Analytical features of power systems analysis software program shall have capability to calculate "mandatory" features as listed in IEEE 399.
- C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram of modeled power system, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Conductor types, sizes, and lengths.
 - 3. Transformer kilovolt ampere (kVA) and voltage ratings.
 - 4. Motor and generator designations and kVA ratings.
 - 5. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
 - 6. Derating factors and environmental conditions.
 - 7. Any revisions to electrical equipment required by the study.
- D. Comments and recommendations for system improvements or revisions in a written document, separate from one-line diagram.
- E. Protective Device Evaluation:
 - 1. Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
 - 2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
 - 3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
 - 4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.
- F. Short-Circuit Study Input Data:
 - 1. One-line diagram of system being studied.
 - 2. Power sources available.
 - 3. Manufacturer, model, and interrupting rating of protective devices.
 - 4. Conductors.
 - 5. Transformer data.
- G. Short-Circuit Study Output Reports:
 - 1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. Equivalent impedance.
 - 2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device 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.
3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device 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.

PART 3 - EXECUTION

3.1 POWER SYSTEM DATA

- A. Obtain all data necessary for conduct of the study.
- B. Gather and tabulate the required input data to support the short-circuit study. Comply with requirements in Section 01 78 39 "Project Record Documents" for recording circuit protective device characteristics. Record data on a Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification.

3.2 SHORT-CIRCUIT STUDY

- A. Perform study following the general study procedures contained in IEEE 399.
- B. Calculate short-circuit currents according to IEEE 551.
- C. Base study on device characteristics supplied by device manufacturer.
- D. Extent of electrical power system to be studied is indicated on Drawings.
- E. Begin short-circuit current analysis at the service, extending down to system overcurrent protective devices as follows:
 - 1. To normal system low-voltage load buses where fault current is 10 kA or less.
- F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

- G. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for the fault-current dc decrement to address asymmetrical requirements of interrupting equipment.
- H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.
 - 1. 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.
- I. Include in the report identification of any protective device applied outside its capacity.

END OF SECTION 26 05 73.13

SECTION 26 05 73.16 - COORDINATION STUDIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. For computer software program to be used for studies.
 - 2. Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.
 - a. Coordination-study input data, including completed computer program input data sheets.
 - b. Study and equipment evaluation reports.
 - 3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.
 - a. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
 - 1. For Power System Analysis Software Developer.
 - 2. For Power Systems Analysis Specialist.
 - 3. For Field Adjusting Agency.
- B. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Studies shall be performed using commercially developed and distributed software designed specifically for power system analysis.
- B. Software algorithms shall comply with requirements of standards and guides specified in this Section.
- C. Manual calculations are unacceptable.
- D. Power System Analysis Software Qualifications:
 - 1. Computer program shall be designed to perform coordination studies or have a function, component, or add-on module designed to perform coordination studies.
 - 2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- E. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- F. Power Systems Analysis Companies: The Study shall be performed by one of the following companies, as a sub-contractor to the bidding Electrical Contractor. Companies other than those listed below will be Rejected for non-compliance.
 - 1. Utilities Instrumentation Services (UIS)
 - 2. Power Factor Engineering, LLC
 - 3. Northern Electrical Testing
 - 4. Schneider Electric (Square-D) (as part of the new distribution equipment).
 - 5. Eaton Power Systems (as part of the new distribution equipment).
 - 6. Siemens Power Systems (as part of the new distribution equipment).
- G. Field Adjusting Agency Qualifications:
 - 1. Employer of a NETA ETT-Certified Technician Level III responsible for all field adjusting of the Work.
 - 2. A member company of NETA.
 - 3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. EDSA Micro Corporation.
 - 2. SKM Systems Analysis, Inc.
- B. Comply with IEEE 242 and IEEE 399.
- C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory" features as listed in IEEE 399.

- D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

2.2 COORDINATION STUDY REPORT CONTENTS

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram of modeled power system, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Conductor types, sizes, and lengths.
 - 3. Transformer kilovolt ampere (kVA) and voltage ratings.
 - 4. Motor and generator designations and kVA ratings.
 - 5. Switchgear, switchboard, motor-control center, and panelboard designations.
 - 6. Any revisions to electrical equipment required by the study.
 - 7. Study Input Data: As described in "Power System Data" Article.
 - a. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 26 05 73.13 "Short-Circuit Studies."
- D. Protective Device Coordination Study:
 - 1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.
 - a. Phase and Ground Relays:
 - 1) Device tag.
 - 2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
 - 3) Recommendations on improved relaying systems, if applicable.
 - b. Circuit Breakers:
 - 1) Adjustable pickups and time delays (long time, short time, and ground).
 - 2) Adjustable time-current characteristic.
 - 3) Adjustable instantaneous pickup.
 - 4) Recommendations on improved trip systems, if applicable.
 - c. Fuses: Show current rating, voltage, and class.
- E. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:
 - a. Power utility's overcurrent protective device.
 - b. Low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
 - c. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
 - d. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
 - e. Ground-fault protective devices.
 - f. The largest feeder circuit breaker in each motor-control center and panelboard.
5. Maintain selectivity for tripping currents caused by overloads.
6. Provide adequate time margins between device characteristics such that selective operation is achieved.
7. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance of the Work. Devices to be coordinated are indicated on Drawings.
 1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

- A. Obtain all data necessary for conduct of the overcurrent protective device study.
 1. Verify completeness of data supplied in one-line diagram on Drawings. Call any discrepancies to Architect's attention.
 2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
- B. Gather and tabulate all required input data to support the coordination study. List below is a guide. Comply with recommendations in IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification.

3.3 COORDINATION STUDY

- A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.
- B. Comply with IEEE 399 for general study procedures.
- C. Base study on device characteristics supplied by device manufacturer.
- D. Extent of electrical power system to be studied is indicated on Drawings.
- E. Begin analysis at the service, extending down to system overcurrent protective devices as follows:
 - 1. To normal system low-voltage load buses where fault current is 10 kA or less.
- F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.
- G. Transformer Primary Overcurrent Protective Devices:
 - 1. Device shall not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
 - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
 - 2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.
- H. Motor Protection:
 - 1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
 - 2. Select protection for motors served at voltages more than 600 V according to IEEE 620.
- I. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.
- J. Generator Protection: Select protection according to manufacturer's written instructions and to IEEE 242.
- K. Include the ac fault-current decay from induction motors and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement, to address asymmetrical requirements of interrupting equipment.
- L. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.

1. 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.

M. 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. Include in the report identification of any protective device applied outside its capacity.

3.4 FIELD ADJUSTING

- A. Adjust relay and protective device settings according to recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of equipment manufacturer under the "Startup and Acceptance Testing" contract portion.
- B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.
- C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification.
 1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

3.5 DEMONSTRATION

- A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in the following:
 1. Acquaint personnel in fundamentals of operating the power system in normal and emergency modes.
 2. Hand-out and explain the coordination study objectives, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting time-current coordination curves.
 3. For Owner's maintenance staff certified as NETA ETT-Certified Technicians Level III or NICET Electrical Power Testing Level III Technicians, teach how to adjust, operate, and maintain overcurrent protective device settings.

END OF SECTION 26 05 73.16

SECTION 26 05 73.19 - ARC-FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.2 ACTION SUBMITTALS

- A. Product Data: For computer software program to be used for studies.
- B. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form:
 - 1. Arc-flash study input data, including completed computer program input data sheets.
 - 2. Arc-flash study report; signed, dated, and sealed by Power Systems Analysis Specialist.
 - 3. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
 - 1. For Power Systems Analysis Software Developer.
 - 2. For Power System Analysis Specialist.
 - 3. For Field Adjusting Agency.
- B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.
- B. Software algorithms shall comply with requirements of standards and guides specified in this Section.
- C. Manual calculations are unacceptable.

- D. Power System Analysis Software Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
 - 1. Computer program shall be designed to perform arc-flash analysis or have a function, component, or add-on module designed to perform arc-flash analysis.
 - 2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- E. Power Systems Analysis Specialist Qualifications: Professional engineer in charge of performing the arc-flash study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- F. Arc-Flash Study Certification: Arc-Flash Study Report shall be signed and sealed by Power Systems Analysis Specialist.
- G. Power Systems Analysis Companies: The Study shall be performed by one of the following companies, as a sub-contractor to the bidding Electrical Contractor. Companies other than those listed below will be Rejected for non-compliance.
 - 1. Utilities Instrumentation Services (UIS)
 - 2. Power Factor Engineering, LLC
 - 3. Northern Electrical Testing
 - 4. Schneider Electric (Square-D) (as part of the new distribution equipment).
 - 5. Eaton Power Systems (as part of the new distribution equipment).
 - 6. Siemens Power Systems (as part of the new distribution equipment).
- H. Field Adjusting Agency Qualifications:
 - 1. Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
 - 2. A member company of NETA.
 - 3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. EDSA Micro Corporation.
 - 2. SKM Systems Analysis, Inc.
- B. Comply with IEEE 1584 and NFPA 70E.
- C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory" features as listed in IEEE 399.

2.2 ARC-FLASH STUDY REPORT CONTENT

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Conductor types, sizes, and lengths.
 - 3. Transformer kilovolt ampere (kVA) and voltage ratings, including derating factors and environmental conditions.
 - 4. Motor and generator designations and kVA ratings.
 - 5. Switchgear, switchboard, motor-control center, panelboard designations, and ratings.
- D. Study Input Data: As described in "Power System Data" Article.
- E. Short-Circuit Study Output Data: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 26 05 73.13 "Short-Circuit Studies."
- F. Protective Device Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 26 05 73.16 "Coordination Studies."
- G. Arc-Flash Study Output Reports:
 - 1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in the report:
 - 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.
- H. 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. Restricted approach boundary.
 - 6. Limited approach boundary.
 - 7. Working distance.
 - 8. Incident energy.
 - 9. Hazard risk category.
 - 10. Recommendations for arc-flash energy reduction.
- I. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of computer printout.

2.3 ARC-FLASH WARNING LABELS

- A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch (76-by-127-mm) self-adhesive equipment label for each work location included in the analysis.
- B. Label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
 - 1. Location designation.
 - 2. Nominal voltage.
 - 3. Protection boundaries.
 - a. Arc-flash boundary.
 - b. Restricted approach boundary.
 - c. Limited approach boundary.
 - 4. Arc flash PPE category.
 - 5. Required minimum arc rating of PPE in Cal/cm squared.
 - 6. Available incident energy.
 - 7. Working distance.
 - 8. Engineering report number, revision number, and issue date.
- C. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 ARC-FLASH HAZARD ANALYSIS

- A. Comply with NFPA 70E and its Annex D for hazard analysis study.
- B. Preparatory Studies: Perform the Short-Circuit and Protective Device Coordination studies prior to starting the Arc-Flash Hazard Analysis.
 - 1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 26 05 73.13 "Short-Circuit Studies."
 - 2. Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 26 05 73.16 "Coordination Studies."
- C. Calculate maximum and minimum contributions of fault-current size.
 - 1. Maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
 - 2. Calculate arc-flash energy at 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.

3. Calculate arc-flash energy at 38 percent of maximum short-circuit current according to NFPA 70E recommendations.
 4. Calculate arc-flash energy with the utility contribution at a minimum and assume no motor contribution.
- D. Calculate the arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.
- E. Include low-voltage equipment locations.
- F. Calculate the limited, restricted, and prohibited approach boundaries for each location.
- G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:
1. Fault contribution from induction motors shall not be considered beyond three to five cycles.
- H. Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:
1. When the circuit breaker is in a separate enclosure.
 2. When the line terminals of the circuit breaker are separate from the work location.
- I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 POWER SYSTEM DATA

- A. Obtain all data necessary for conduct of the arc-flash hazard analysis.
1. Verify completeness of data supplied on one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to Architect's attention.
 2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.

3.4 LABELING

- A. Apply one arc-flash label on the front cover of each section of the equipment and on side or rear covers with accessible live parts and hinged doors or removable plates for each equipment included in the study. Base arc-flash label data on highest values calculated at each location.
- B. Each piece of equipment listed below shall have an arc-flash label applied to it:
1. Motor-control center.
 2. Low-voltage switchboard.
 3. Switchgear.
 4. Medium-voltage switch.
 5. Medium voltage transformers

6. Low voltage transformers.
7. Panelboard and safety switch over 250 V.
8. Applicable panelboard and safety switch under 250 V.
9. Control panel.

C. Note on record Drawings the location of equipment where the personnel could be exposed to arc-flash hazard during their work.

1. Indicate arc-flash energy.
2. Indicate protection level required.

3.5 APPLICATION OF WARNING LABELS

A. Install arc-flash warning labels under the direct supervision and control of Power System Analysis Specialist.

3.6 DEMONSTRATION

A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in potential arc-flash hazards associated with working on energized equipment and the significance of arc-flash warning labels.

END OF SECTION 26 05 73.19

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Lighting and appliance branch-circuit panelboards.

1.2 DEFINITIONS

- A. MCCB: Molded-case circuit breaker.
- B. SPD: Surge protective device.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details.
 - 2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Include evidence of NRTL listing for SPD as installed in panelboard.
 - 7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 8. Include wiring diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 FIELD CONDITIONS

- A. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet (2000 m).

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
 - 1. Panelboard Warranty Period: 18 months from date of Substantial Completion.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.
 - 1. SPD Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 26 05 48.16 "Seismic Controls for Electrical Systems."
- B. 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.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.
- E. Enclosures: Flush and Surface-mounted, dead-front cabinets, as indicated on drawings.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Kitchen and/or Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 - 2. Height: 84 inches (2.13 m) maximum.
 - 3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
 - 4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
- F. Incoming Mains Location: Convertible between top and bottom.
- G. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.
- H. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.

3. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
 - I. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
 - J. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
 - K. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
- B. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. ABB, Electrification Products Division.
 2. Eaton.
 3. Siemens Industry, Inc., Energy Management Division.
 4. Schneider Electric, Square-D Company.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only, as indicated on drawing.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. SPD. Where indicated on drawings, comply with the following.
 1. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
 2. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:
 - a. Line to Neutral: 700 V for 208Y/120 V.
 - b. Line to Ground: 700 V for 208Y/120 V.
 - c. Neutral to Ground: 700 V for 208Y/120 V.

- d. Line to Line: 1200 V for 208Y/120 V.
 - 3. SCCR: Equal to the SCCR of the panelboard in which installed.
 - 4. Nominal Rating: 20 kA.
- F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. ABB, Electrification Products Division.
 - 2. Eaton.
 - 3. Siemens Industry, Inc., Energy Management Division.
 - 4. Schneider Electric, Square-D Company.
- B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
- 1. Thermal-Magnetic Circuit Breakers:
 - a. Inverse time-current element for low-level overloads.
 - b. Instantaneous magnetic trip element for short circuits.
 - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
 - 3. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 - 4. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Breaker handle indicates tripped status.
 - c. UL listed for reverse connection without restrictive line or load ratings.
 - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
 - f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.5 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install panelboards and accessories according to NECA 407.
- C. Mount top of trim no higher than 90 inches (2286 mm) above finished floor; and adjust as required to meet the requirements of the NEC for the distance to the operating handle of the top-most circuit breaker in the panel.
- D. Mount panelboard cabinet plumb and rigid without distortion of box.
- E. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- F. Install overcurrent protective devices and controllers not already factory installed.
- G. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- H. Install filler plates in unused spaces.
- I. Stub four 1-inch (27-EMT) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-EMT) empty conduits into raised floor space or below slab not on grade.
- J. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems" identifying source of remote circuit.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers 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.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General-use switches, dimmer switches, and fan-speed controller switches.
2. General-grade duplex straight-blade receptacles.
3. Receptacles with ground-fault protective devices.

B. Related Requirements:

1. Section 26 00 10 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Toggle switches.
2. Duplex straight-blade receptacles.
3. Receptacles with GFCI device.

PART 2 - PRODUCTS

2.1 GENERAL-USE SWITCHES, DIMMER SWITCHES, AND FAN-SPEED CONTROLLER SWITCHES

A. Toggle Switch:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
 - b. Leviton Manufacturing Co., Inc.
 - c. Pass & Seymour; Legrand North America, LLC.
 - d. Hubbell.
2. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
3. General Characteristics:

- a. Reference Standards: UL CCN WMUZ and UL 20.
- 4. Options:
 - a. Device Color: To be selected by Architect.
 - b. Configuration:
 - 1) Extra-heavy-duty, 120-277 V, 20 A, single pole or three-way, as indicated on drawings.

2.2 GENERAL-GRADE DUPLEX STRAIGHT-BLADE RECEPTACLES

A. Duplex Straight-Blade Receptacle:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
 - b. Leviton Manufacturing Co., Inc.
 - c. Pass & Seymour; Legrand North America, LLC.
 - d. Hubbell.
- 2. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
- 3. General Characteristics:
 - a. Reference Standards: UL CCN RTRT and UL 498.
- 4. Options:
 - a. Device Color: To be selected by Architect.
 - b. Configuration:
 - 1) Extra-heavy-duty, NEMA 5-20R.

B. Tamper-Resistant Duplex Straight-Blade Receptacle:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
 - b. Leviton Manufacturing Co., Inc.
 - c. Pass & Seymour; Legrand North America, LLC.
 - d. Hubbell.
- 2. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

3. General Characteristics:
 - a. Reference Standards: UL CCN RTRT and UL 498.
 4. Options:
 - a. Device Color: To be selected by Architect.
 - b. Configuration:
 - 1) Extra-heavy-duty, NEMA 5-20R.
- C. Tamper-Resistant Duplex Straight-Blade Receptacle with USB Outlet to Power Class 2 Equipment:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
 - b. Leviton Manufacturing Co., Inc.
 - c. Pass & Seymour; Legrand North America, LLC.
 - d. Hubbell.
 2. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 3. General Characteristics:
 - a. Reference Standards: UL CCN RTRT and UL 498.
 4. Options:
 - a. Device Color: To be selected by Architect.
 - b. Configuration:
 - 1) Heavy-duty, NEMA 5-20R; one USB-A port; one USB-C port.

2.3 RECEPTACLES WITH GROUND-FAULT PROTECTIVE DEVICES

- A. General-Grade Duplex Straight-Blade Receptacle with GFCI Device:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
 - b. Leviton Manufacturing Co., Inc.
 - c. Pass & Seymour; Legrand North America, LLC.
 - d. Hubbell.
 2. Options:
 - a. Device Color: To be selected by Architect.
 - b. Configuration: Extra Heavy-duty, NEMA 5-20R.

- B. General-Grade, Weather-Resistant, Tamper-Resistant Duplex Straight-Blade Receptacle with GFCI Device:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
 - b. Leviton Manufacturing Co., Inc.
 - c. Pass & Seymour; Legrand North America, LLC.
 - d. Hubbell.
 2. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 3. General Characteristics:
 - a. Reference Standards: UL CCN KCXS, UL 498, and UL 943.
 4. Options:
 - a. Device Color: To be selected by Architect.
 - b. Configuration: Extra Heavy-duty, NEMA 5-20R.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receptacles:
1. Verify that receptacles to be procured and installed for Owner-furnished equipment are compatible with mating attachment plugs on equipment.

3.2 INSTALLATION OF SWITCHES

- A. Comply with manufacturer's instructions.
- B. Reference Standards:
1. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA NEIS 130.
 2. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
 3. Consult Architect for resolution of conflicting requirements.
- C. Identification:
1. Identify cover or cover plate for device with panelboard identification and circuit number in accordance with Section 26 05 53 "Identification for Electrical Systems."

- a. Mark cover or cover plate using hot, stamped, or engraved machine printing with black-filled lettering, and provide durable wire markers or tags inside device box or outlet box.

3.3 INSTALLATION OF STRAIGHT-BLADE RECEPTACLES

- A. Comply with manufacturer's instructions.
- B. Reference Standards:
 1. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA NEIS 130.
 2. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
 3. Receptacle Orientation: Unless otherwise indicated in Contract Documents, orient receptacle to match configuration diagram in NEMA WD 6.
 4. Consult Architect for resolution of conflicting requirements.
- C. Identification:
 1. Identify cover or cover plate for device with panelboard identification and circuit number in accordance with Section 26 05 53 "Identification for Electrical Systems."
 - a. Mark cover or cover plate using hot, stamped, or engraved machine printing with black-filled lettering, and provide durable wire markers or tags inside device box or outlet box.

3.4 FIELD QUALITY CONTROL OF STRAIGHT-BLADE RECEPTACLES

- A. Tests and Inspections:
 1. Insert and remove test plug to verify that device is securely mounted.
 2. Verify polarity of hot and neutral pins.
 3. Measure line voltage.
 4. Measure percent voltage drop. Voltage drop shall not exceed 5%. Electrical Contractor shall be responsible for correcting the branch circuit wiring to provide a voltage drop within the acceptable maximum limit of 5%. Retest until voltage drop is 5% or less.
 5. Measure grounding circuit continuity; impedance must be not greater than 2 ohms.
 6. Perform additional installation and maintenance inspections and diagnostic tests in accordance with NECA NEIS 130 and manufacturers' instructions.
- B. Nonconforming Work:
 1. Device will be considered defective if it does not pass tests and inspections.
 2. Remove and replace defective units and retest.
- C. Assemble and submit test and inspection reports.

3.5 PROTECTION

A. Devices:

1. Schedule and sequence installation to minimize risk of contamination of wires and cables, devices, device boxes, outlet boxes, covers, and cover plates by plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other materials.
2. After installation, protect wires and cables, devices, device boxes, outlet boxes, covers, and cover plates from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 26 27 26

SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cartridge fuses rated 600 V ac and less for use in the following:
 - a. Control circuits.
 - b. Panelboards.
 - c. Switchboards.
 - d. Enclosed controllers.
 - e. Enclosed switches.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Bussmann; Eaton, Electrical Sector.
 - 2. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
 - 1. Type RK-1: 250-V, zero- to 600-A rating, 200 kAIC, time delay.
 - 2. Type RK-5: 250-V, zero- to 600-A rating, 200 kAIC, time delay.
 - 3. Type CC: 600-V, zero- to 30-A rating, 200 kAIC, fast acting.
 - 4. Type CD: 600-V, 31- to 60-A rating, 200 kAIC, fast acting.
 - 5. Type J: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
 - 6. Type L: 600-V, 601- to 6000-A rating, 200 kAIC, time delay.
 - 7. Type T: 250-V, zero- to 1200-A rating, 200 kAIC, time delay.

- B. 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.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.2 FUSE APPLICATIONS

- A. Cartridge Fuses:
 - 1. Service Entrance: Class RK1, time delay.
 - 2. Feeders: Class RK1, time delay, Class RK5, fast acting or Class RK5, time delay as determined by the Coordination Study and Arc Flash Hazard Analysis to be performed as part of the project for proper coordination and Arc Flash mitigation.
 - 3. Motor Branch Circuits: Class RK1, time delay.
 - 4. Large Motor Branch (601-4000 A): Class L, time delay.
 - 5. Power Electronics Circuits: Class J, high speed.
 - 6. Other Branch Circuits: Class RK1, time delay.
 - 7. Control Transformer Circuits: Class CC, time delay, control transformer duty.
 - 8. Provide open-fuse indicator fuses or fuse covers with open fuse indication.

3.3 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 26 28 13

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers (MCCBs).
 - 4. Enclosures.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
- B. Shop Drawings: For enclosed switches and circuit breakers.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include wiring diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. 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.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

2.3 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB, Electrification Products Division.
 - 2. Eaton.
 - 3. Siemens Industry, Inc., Energy Management Division.
 - 4. Schneider Electric, Square-D Company.
- B. Type HD, Heavy Duty:
 - 1. Single throw.
 - 2. Three pole or two pole, as indicated on drawings.
 - 3. 240-V ac.
 - 4. 1200 A and smaller.
 - 5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses.
 - 6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Service-Rated Switches: Labeled for use as service equipment.

2.4 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. ABB, Electrification Products Division.
 2. Eaton.
 3. Siemens Industry, Inc., Energy Management Division.
 4. Schneider Electric, Square-D Company.
- B. Type HD, Heavy Duty, Three Pole (or Two Pole as indicated on drawing), Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 3. Service-Rated Switches: Labeled for use as service equipment.

2.5 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. ABB, Electrification Products Division.
 2. Eaton.
 3. Siemens Industry, Inc., Energy Management Division.
 4. Schneider Electric, Square-D Company.
- B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
- C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.
- D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated. Circuit breaker/circuit breaker combinations for series connected interrupting ratings shall be listed by UL as recognized

component combinations. Any series rated combination used shall be marked on the end-use equipment along with the statement "Caution - Series Rated System. _____ Amps Available. Identical Replacement Component Required."

- E. MCCBs shall be equipped with a device for locking in the isolated position.
- F. Lugs shall be suitable for 194 deg F (90 deg C) rated wire, sized according to the 167 deg F (75 deg C) temperature rating in NFPA 70.
- G. Standards: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- H. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal 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.
- I. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 - 3. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - 4. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 - 5. Alarm Switch: One NC contact that operates only when circuit breaker has tripped.

2.6 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized galvanized steel (NEMA 250 Types 3R, 12).
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.
- D. Operating Mechanism: The circuit-breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.
- E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.
- F. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

PART 3 - EXECUTION

3.1 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R.
 - 3. Kitchen or Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

3.2 INSTALLATION

- A. 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 Owner no fewer than seven days in advance of proposed interruption of electric service.
 - 2. Indicate method of providing temporary electric service.
 - 3. Do not proceed with interruption of electric service without Owner's written permission.
 - 4. Comply with NFPA 70E.
- B. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- C. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in fusible devices.
- F. Comply with NFPA 70 and NECA 1.
- G. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 05 73.16 "Coordination Studies."

3.3 IDENTIFICATION

- A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections for Switches:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, grounding, and clearances.
 - c. Verify that the unit is clean.
 - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
 - e. Verify that fuse sizes and types match the Specifications and Drawings.
 - f. Verify that each fuse has adequate mechanical support and contact integrity.
 - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
 - i. Verify correct phase barrier installation.
 - j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
 - 2. Electrical Tests:
 - a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.

- d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
- e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

D. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:

- a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
- b. Inspect physical and mechanical condition.
- c. Inspect anchorage, alignment, grounding, and clearances.
- d. Verify that the unit is clean.
- e. Operate the circuit breaker to ensure smooth operation.
- f. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
- g. Inspect operating mechanism, contacts, and chutes in unsealed units.
- h. Perform adjustments for final protective device settings in accordance with the coordination study.

2. Electrical Tests:

- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
- b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
- c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
- d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state

components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.

3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.
1. Test procedures used.
 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
 3. List deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 26 28 16

SECTION 26 29 13.03 - MANUAL AND MAGNETIC MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manual motor controllers.
 - 2. Enclosed full-voltage magnetic motor controllers.
 - 3. Enclosures.
 - 4. Accessories.
 - 5. Identification.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of magnetic controller.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Indicate dimensions, weights, required clearances, and location and size of each field connection.
 - 3. Wire Termination Diagrams and Schedules: Include diagrams for signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.
 - 4. Include features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.3 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Data: Certificates, for magnetic controllers, from manufacturer.
- B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

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 use.
- B. UL Compliance: Fabricate and label magnetic motor controllers to comply with UL 508 and UL 60947-4-1.
- C. NEMA Compliance: Fabricate motor controllers to comply with ICS 2.
- D. Seismic Performance: Magnetic controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the controller will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Component Importance Factor: 1.0.

2.2 MANUAL MOTOR CONTROLLERS

- A. Fractional Horsepower Manual Controllers (FHPMC): "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Eaton.
 - c. Rockwell Automation, Inc.
 - d. Siemens Industry, Inc., Energy Management Division.
 - e. Square D; Schneider Electric USA.
 - 2. Configuration: Nonreversing.
 - 3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type.
 - 4. Overload Relays: NEMA ICS 2, bimetallic class as schedule on Drawings.
 - 5. Pilot Light: Red.

2.3 ENCLOSED FULL-VOLTAGE MAGNETIC MOTOR CONTROLLERS

- A. Description: Across-the-line start, electrically held, for nominal system voltage of 600-V ac and less.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB, Electrification Products Division.
 - 2. Eaton.
 - 3. Rockwell Automation, Inc.

4. Siemens Industry, Inc., Energy Management Division.
 5. Square D; Schneider Electric USA.
- C. Standard: Comply with NEMA ICS 2, general purpose, Class A.
- D. Configuration: Nonreversing.
- E. Contactor Coils: Pressure-encapsulated type with coil transient suppressors when indicated.
1. Operating Voltage: Manufacturer's standard, unless indicated.
- F. Control Power:
1. For on-board control power, obtain from line circuit or from integral CPT. The CPT shall have capacity to operate integral devices and remotely located pilot, indicating, and control devices.
- G. Overload Relays:
1. Solid-State Overload Relay:
 - a. Switch or dial selectable for motor-running overload protection.
 - b. Sensors in each phase.
 - c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 - d. Class II ground-fault protection shall comply with UL 1053 to interrupt low-level ground faults. The ground-fault detection system shall include circuitry that will prevent the motor controller from tripping when the fault current exceeds the interrupting capacity of the controller. Equip with start and run delays to prevent nuisance trip on starting, and a trip indicator.

2.4 ENCLOSURES

- A. Comply with NEMA 250, type designations as indicated on Drawings, complying with environmental conditions at installed location.
- B. The construction of the enclosures shall comply with NEMA ICS 6.

2.5 ACCESSORIES

- A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
 1. Push Buttons, Pilot Lights, and Selector Switches: Standard-duty, except as needed to match enclosure type. Heavy-duty or oil-tight where indicated in the controller schedule.
 - a. Push Buttons: As indicated in the controller schedule.
 - b. Pilot Lights: As indicated in the controller schedule.

2.6 IDENTIFICATION

- A. Controller Nameplates: Laminated acrylic or melamine plastic signs, as described in Section 26 05 53 "Identification for Electrical Systems," for each compartment, mounted with corrosion-resistant screws.
- B. Arc-Flash Warning Labels:
 - 1. Comply with requirements in Section 26 05 73.19 "Arc-Flash Hazard Analysis." Produce a 3.5-by-5-inch (89-by-127-mm) self-adhesive equipment label for each work location included in the analysis.
 - a. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
 - 1) Location designation.
 - 2) Nominal voltage.
 - 3) Flash protection boundary.
 - 4) Hazard risk category.
 - 5) Incident energy.
 - 6) Working distance.
 - 7) Engineering report number, revision number, and issue date.
 - b. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Wall-Mounted Controllers: Install magnetic controllers on walls with tops at uniform height indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 26 05 29 "Hangers and Supports for Electrical Systems" unless otherwise indicated.
- C. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.
- D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- E. Setting of Overload Relays: Select and set overloads on the basis of full-load current rating as shown on motor nameplate. Adjust setting value for special motors as required by NFPA 70 for motors that are high-torque, high-efficiency, and so on.

3.2 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections with the assistance of a factory-authorized service representative.
- B. Tests and Inspections:
 - 1. Comply with the provisions of NFPA 70B, "Testing and Test Methods" Chapter.
 - 2. Visual and Mechanical Inspection:
 - a. Compare equipment nameplate data with drawings and specifications.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage, alignment, and grounding.
 - d. Verify the unit is clean.
 - e. Inspect contactors:
 - 1) Verify mechanical operation.
 - 2) Verify contact gap, wipe, alignment, and pressure are according to manufacturer's published data.
 - f. Motor-Running Protection:
 - 1) Verify overload element rating is correct for its application.
 - 2) If motor-running protection is provided by fuses, verify correct fuse rating.
 - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter. Compare bolted connection resistance values with values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - h. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
 - 3. Electrical Tests:
 - a. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
 - b. Test motor protection devices according to manufacturer's published data.
 - c. Test circuit breakers as follows:
 - 1) Operate the circuit breaker to ensure smooth operation.
 - 2) For adjustable circuit breakers, adjust protective device settings according to the coordination study. Comply with coordination study recommendations.
 - d. Perform operational tests by initiating control devices.
- C. Motor controller will be considered defective if it does not pass tests and inspections.

- D. Prepare test and inspection reports.

3.4 SYSTEM FUNCTION TESTS

- A. System function tests shall prove the correct interaction of sensing, processing, and action devices. Perform system function tests after field quality control tests have been completed and all components have passed specified tests.
 - 1. Develop test parameters and perform tests for the purpose of evaluating performance of integral components and their functioning as a complete unit within design requirements and manufacturer's published data.
 - 2. Verify the correct operation of interlock safety devices for fail-safe functions in addition to design function.
 - 3. Verify the correct operation of sensing devices, alarms, and indicating devices.
- B. Motor controller will be considered defective if it does not pass the system function tests and inspections.
- C. Prepare test and inspection reports.

3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain motor controllers.

END OF SECTION 26 29 13.03

SECTION 26 51 19 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for interior LED luminaires. Refer to drawings for lighting fixture schedule and exact specifications of lighting fixtures.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- 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.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved.
- B. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.
- C. Product Certificates: For each type of luminaire.
- D. Product test reports.
- E. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 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. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.6 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) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."
- C. Ambient Temperature: 41 to 104 deg F (5 to 40 deg C).
 - 1. Relative Humidity: Zero to 95 percent.
- D. Altitude: Sea level to 1000 feet (300 m).

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. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. 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.
- C. Recessed luminaires shall comply with NEMA LE 4.
- D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

2.3 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. Steel:
 - 1. ASTM A36/A36M for carbon structural steel.
 - 2. ASTM A568/A568M for sheet steel.
- C. Stainless Steel:
 - 1. 1. Manufacturer's standard grade.
 - 2. 2. Manufacturer's standard type, ASTM A240/240M.
- D. Galvanized Steel: ASTM A653/A653M.
- E. Aluminum: ASTM B209.

2.4 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.

2.5 LUMINAIRE SUPPORT

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- D. Rod Hangers: 3/16-inch (5-mm) 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 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

- C. Install lamps in each luminaire.
- D. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 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 a vertical force of 400 percent of luminaire weight.
- E. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.2 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.3 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.

3.4 STARTUP SERVICE

- A. Comply with requirements for startup specified on the drawings.

END OF SECTION 26 51 19

SECTION 26 56 19 - LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
 - 2. Luminaire supports.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of luminaire.
- 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.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
 - 1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
 - 2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.5 FIELD CONDITIONS

- A. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 5 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

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 shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. UL Compliance: Comply with UL 1598 and listed for wet location.
- D. CRI and CCT as specified in the lighting fixture schedule on the drawings.
- E. L70 lamp life as specified in the lighting fixture schedule on the drawings.
- F. Dimming range as specified in the lighting fixture schedule on the drawings.
- G. Nominal Operating Voltage: As specified in the lighting fixture schedule on the drawings.
- H. In-line Fusing: Where specified in the lighting fixture schedule on the drawings, provide in-line fusing.
- I. Lamp Rating: As specified in the lighting fixture schedule on the drawings.
- J. Source Limitations:
 - 1. Obtain luminaires from single source from a single manufacturer.

2. For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 MATERIALS

- A. Metal Parts: Free of burrs and sharp corners and edges.
- B. Sheet Metal Components: As specified in the lighting fixture schedule on the drawings. Form and support to prevent warping and sagging.
- C. 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.
- D. Diffusers and Globes: As specified in the lighting fixture schedule on the drawings.
- E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- F. 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.
- G. Housings:
 1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
 2. Provide filter/breather for enclosed luminaires.

2.4 FINISHES

- A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. 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.
- C. 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.
- D. 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, 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 or SSPC-SP 8.

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 specified in the lighting fixture schedule on the drawings.

2.5 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Fasten luminaire to structural support.
- D. Supports:
 1. Sized and rated for luminaire weight.
 2. Able to maintain luminaire position after cleaning and relamping.
 3. Support luminaires without causing deflection of finished surface.
 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- E. Wall-Mounted Luminaire Support:
 1. Attached to structural members in walls, unless otherwise noted on the drawings or directed by the Architectural documents to fasten in another manner.
- F. Wiring Method: Install cables in raceways. Conceal raceways and cables.
- G. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.
- H. Coordinate layout and installation of luminaires with other construction.
- I. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.
- J. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" and Section 26 05 33 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.2 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

- A. Aim as indicated on Drawings.
- B. Install on concrete base with top base at the elevation above finished grade or surface at luminaire location as noted on the drawings and associated base details. The elevation of the top of the concrete base above the finished grade or surface is dependent upon the location of the fixture and proximity to vehicle traffic. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 03 30 00 "Cast-in-Place Concrete."

3.3 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 Section 26 05 33 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. 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. Verify operation of photoelectric controls.
- C. Luminaire will be considered defective if it does not pass tests and inspections.
- 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.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

END OF SECTION 26 56 19

SECTION 31 10 00 - SITE CLEARING

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. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Stripping and stockpiling rock.
6. Removing above- and below-grade site improvements.
7. Disconnecting, capping or sealing, and removing site utilities, abandoning site utilities in place.
8. Temporary erosion and sedimentation control.

- B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

- C. Related Requirements:

1. Section 01500 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

1.3 DEFINITIONS

- A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.
- D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches (50 mm) in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

- E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.
- G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 MATERIAL OWNERSHIP

- A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.6 INFORMATIONAL SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
 - 1. Use sufficiently detailed photographs or video recordings.
 - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.
- B. Topsoil stripping and stockpiling program.
- C. Rock stockpiling program.
- D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.
- E. Burning: Documentation of compliance with burning requirements and permitting of authorities having jurisdiction. Identify location(s) and conditions under which burning will be performed.

1.7 QUALITY ASSURANCE

- A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.
- B. Rock Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.8 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
 - 1. Do not proceed with work on adjoining property until directed by Architect.
- C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- D. Utility Locator Service: Notify Miss Dig for this area where Project is located before site clearing.
- E. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.
- F. Tree- and Plant-Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection."
- G. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."
 - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.
- B. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #23 (surface-tolerant, anticorrosive metal primer) or SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.

- B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 015639 "Temporary Tree and Plant Protection."
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

- A. Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.4 EXISTING UTILITIES

- A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
 - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
 - 1. Arrange with utility companies to shut off indicated utilities.
 - 2. Owner will arrange to shut off indicated utilities when requested by Contractor.
- C. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- D. Interrupting 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.

E. Excavate for and remove underground utilities indicated to be removed.

F. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 024116 "Structure Demolition" and Section 024119 "Selective Demolition."

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots larger than **2 inches (50 mm)** in diameter, obstructions, and debris to a depth of **18 inches (450 mm)** below exposed subgrade.
3. Use only hand methods or air spade for grubbing within protection zones.
4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of **8 inches (200 mm)**, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of **6 inches (150 mm)** in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than **2 inches (50 mm)** in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to **72 inches (1800 mm)**.
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 STOCKPILING ROCK

A. Remove from construction area naturally formed rocks that measure more than **1 foot (300 mm)** across in least dimension. Do not include excavated or crushed rock.

1. Separate or wash off non-rock materials from rocks, including soil, clay lumps, gravel, and other objects larger than **2 inches (50 mm)** in diameter; trash, debris, weeds, roots, and other waste materials.
- B. Stockpile rock away from edge of excavations without intermixing with other materials. Cover to prevent windblown debris from accumulating among rocks.
 1. Limit height of rock stockpiles to **36 inches (900 mm)**.
 2. Do not stockpile rock within protection zones.
 3. Dispose of surplus rock. Surplus rock is that which exceeds quantity indicated to be stockpiled or reused.
 4. Stockpile surplus rock to allow later use by the Owner.

3.8 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Burning tree, shrub, and other vegetation waste is permitted according to burning requirements and permitting of authorities having jurisdiction. Control such burning to produce the least smoke or air pollutants and minimum annoyance to surrounding properties. Burning of other waste and debris is prohibited.
- C. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

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. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade walks pavements turf and grasses and plants.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks and pavements.
6. Subbase course and base course for asphalt paving.
7. Subsurface drainage backfill for walls and trenches.
8. Excavating and backfilling trenches for utilities and pits for buried utility structures.
9. Excavating well hole to accommodate elevator-cylinder assembly.

- B. Related Requirements:

1. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
2. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.

1.3 UNIT PRICES

- A. Work of this Section is affected by unit prices for earth moving specified in Section 012200 "Unit Prices."

- B. Quantity allowances for earth moving are included in Section 012100 "Allowances."

- C. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.

1. 24 inches (600 mm) outside of concrete forms other than at footings.
2. 12 inches (300 mm) outside of concrete forms at footings.
3. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
5. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
6. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

1.4 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
 2. Bulk Excavation: Excavation more than **10 feet (3 m)** in width and more than **30 feet (9 m)** in length.
 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed **1 cu. yd. (0.76 cu. m)** for bulk excavation or **3/4 cu. yd. (0.57 cu. m)** for footing, trench, and pit excavation that cannot be removed by rock-excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
1. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a **42-inch- (1065-mm-)** maximum-width, short-tip-radius rock bucket; rated at not less than **138-hp (103-kW)** flywheel power with bucket-curling force of not less than **28,700 lbf (128 kN)** and stick-crowd force of not less than **18,400 lbf (82 kN)** with extra-long reach boom.
 2. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than **230-hp (172-kW)** flywheel power and developing a minimum of **47,992-lbf (213.3-kN)** breakout force with a general-purpose bare bucket.
- I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material **3/4 cu. yd. (0.57 cu. m)** or more in volume that exceed a standard penetration resistance of **100 blows/2 inches (97 blows/50 mm)** when tested by a geotechnical testing agency, according to ASTM D1586.
- J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

- K. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- L. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- M. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct preexcavation conference at Project site.
 - 1. Review methods and procedures related to earthmoving, including, but not limited to, the following:
 - a. Personnel and equipment needed to make progress and avoid delays.
 - b. Coordination of Work with utility locator service.
 - c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
 - d. Extent of trenching by hand or with air spade.
 - e. Field quality control.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
 - 1. Geotextiles.
 - 2. Controlled low-strength material, including design mixture.
 - 3. Geofoam.
 - 4. Warning tapes.
- B. Samples for Verification: For the following products, in sizes indicated below:
 - 1. Geotextile: 12 by 12 inches (300 by 300 mm).
 - 2. Warning Tape: 12 inches (300 mm) long; of each color.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
 - 1. Classification according to ASTM D2487.
 - 2. Laboratory compaction curve according to ASTM D698 and ASTM D1557.
- C. Seismic survey report from seismic survey agency.

- D. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.8 QUALITY ASSURANCE

- A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:
 - 1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
 - 2. Seismographic monitoring during blasting operations.
- B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
 - 1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
 - 2. Seismographic monitoring during blasting operations.
- C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

1.9 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
 - 1. Do not proceed with work on adjoining property until directed by Architect.
- C. Utility Locator Service: Notify MISS DIG for area where Project is located before beginning earth-moving operations.
- D. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 015000 "Temporary Facilities and Controls" and Section 311000 "Site Clearing" are in place.
- E. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.
- F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
 2. Parking vehicles or equipment.
 3. Foot traffic.
 4. Erection of sheds or structures.
 5. Impoundment of water.
 6. Excavation or other digging unless otherwise indicated.
 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- G. Do not direct vehicle or equipment exhaust towards protection zones.
- H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487, or a combination of these groups; free of rock or gravel larger than **3 inches (75 mm)** in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487, or a combination of these groups.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a **1-1/2-inch (37.5-mm)** sieve and not more than 12 percent passing a **No. 200 (0.075-mm)** sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a **1-1/2-inch (37.5-mm)** sieve and not more than 8 percent passing a **No. 200 (0.075-mm)** sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a **1-1/2-inch (37.5-mm)** sieve and not more than 12 percent passing a **No. 200 (0.075-mm)** sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a **1-inch (25-mm)** sieve and not more than 8 percent passing a **No. 200 (0.075-mm)** sieve.
- H. Drainage Course: Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a **1-1/2-inch (37.5-mm)** sieve and zero to 5 percent passing a **No. 8 (2.36-mm)** sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a **1-inch (25-mm)** sieve and zero to 5 percent passing a **No. 4 (4.75-mm)** sieve.

- J. Sand: ASTM C33/C33M; fine aggregate.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

- 1. Survivability: Class 2; AASHTO M 288.
- 2. Survivability: As follows:
 - a. Grab Tensile Strength: 157 lbf (700 N); ASTM D4632.
 - b. Sewn Seam Strength: 142 lbf (630 N); ASTM D4632.
 - c. Tear Strength: 56 lbf (250 N); ASTM D4533.
 - d. Puncture Strength: 56 lbf (250 N); ASTM D4833.
- 3. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D4751.
- 4. Permittivity: 0.5 per second, minimum; ASTM D4491.
- 5. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

- 1. Survivability: Class 2; AASHTO M 288.
- 2. Survivability: As follows:
 - a. Grab Tensile Strength: 247 lbf (1100 N); ASTM D4632.
 - b. Sewn Seam Strength: 222 lbf (990 N); ASTM D4632.
 - c. Tear Strength: 90 lbf (400 N); ASTM D4533.
 - d. Puncture Strength: 90 lbf (400 N); ASTM D4833.
- 3. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D4751.
- 4. Permittivity: 0.02 per second, minimum; ASTM D4491.
- 5. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Self-compacting, low-density, flowable concrete material produced from the following:

- 1. Portland Cement: ASTM C150/C150M, Type I.
- 2. Fly Ash: ASTM C618, Class C or F.
- 3. Normal-Weight Aggregate: ASTM C33/C33M, 3/4-inch (19-mm) nominal maximum aggregate size.
- 4. Foaming Agent: ASTM C869/C869M.
- 5. Water: ASTM C94/C94M.
- 6. Air-Entraining Admixture: ASTM C260/C260M.

- B. Produce low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: 30 to 36 lb/cu. ft. (480 to 576 kg/cu. m) at point of placement, when tested according to ASTM C138/C138M.
 2. Compressive Strength: 80 psi (550 kPa), when tested according to ASTM C495/C495M.
- C. Produce conventional-weight, controlled low-strength material with 80-psi (550-kPa) compressive strength when tested according to ASTM C495/C495M.

2.4 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:
1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.
- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:
1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth-moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

- A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
- D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.
- B. Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.
 - 1. Perform blasting without damaging adjacent structures, property, or site improvements.
 - 2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches (600 mm) outside of concrete forms other than at footings.
 - b. 12 inches (300 mm) outside of concrete forms at footings.
 - c. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
 - f. 6 inches (150 mm) beneath pipe in trenches and the greater of 24 inches (600 mm) Insert dimension wider than pipe or 42 inches (1065 mm) wide.
- B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches (600 mm) outside of concrete forms other than at footings.
 - b. 12 inches (300 mm) outside of concrete forms at footings.
 - c. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
 - f. 6 inches (150 mm) beneath pipe in trenches and the greater of 24 inches (600 mm) Insert dimension wider than pipe or 42 inches (1065 mm) wide.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 2. Pile Foundations: Stop excavations 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
 3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:
 1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to **12 inches (300 mm)** higher than top of pipe or conduit unless otherwise indicated.
 - 1. Clearance: **12 inches (300 mm)** each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - 1. For pipes and conduit less than **6 inches (150 mm)** in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - 2. For pipes and conduit **6 inches (150 mm)** or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
 - 3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
 - 4. Excavate trenches **6 inches (150 mm)** deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Trench Bottoms: Excavate trenches **4 inches (100 mm)** deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
 - 1. Excavate trenches **6 inches (150 mm)** deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- E. Trenches in Tree- and Plant-Protection Zones:
 - 1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 - 2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
 - 3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.8 SUBGRADE INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than **15 tons (13.6 tonnes)** to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.

- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

- C. Trenches under Footings: Backfill trenches excavated under footings and within **18 inches (450 mm)** of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."
- D. Trenches under Roadways: Provide **4-inch- (100-mm-)** thick, concrete-base slab support for piping or conduit less than **30 inches (750 mm)** below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of **4 inches (100 mm)** of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete."
- E. Backfill voids with satisfactory soil while removing shoring and bracing.
- F. Initial Backfill:
 - 1. Soil Backfill: Place and compact initial backfill of subbase material, free of particles larger than **1 inch (25 mm)** in any dimension, to a height of **12 inches (300 mm)** over the pipe or conduit.
 - a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
 - 2. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of **12 inches (300 mm)** over the pipe or conduit. Coordinate backfilling with utilities testing.
- G. Final Backfill:
 - 1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
 - 2. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.
- H. Warning Tape: Install warning tape directly above utilities, **12 inches (300 mm)** below finished grade, except **6 inches (150 mm)** below subgrade under pavements and slabs.

3.13 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than **8 inches (200 mm)** in loose depth for material compacted by heavy compaction equipment and not more than **4 inches (100 mm)** in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698 ASTM D1557:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top **12 inches (300 mm)** of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 2. Under walkways, scarify and recompact top **6 inches (150 mm)** below subgrade and compact each layer of backfill or fill soil material at 92 percent.
 - 3. Under turf or unpaved areas, scarify and recompact top **6 inches (150 mm)** below subgrade and compact each layer of backfill or fill soil material at 85 percent.
 - 4. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
 - 1. Turf or Unpaved Areas: Plus or minus **1 inch (25 mm)**.
 - 2. Walks: Plus or minus **1 inch (25 mm)**.
 - 3. Pavements: Plus or minus **1/2 inch (13 mm)**.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of **1/2 inch (13 mm)** when tested with a **10-foot (3-m)** straightedge.

3.17 SUBSURFACE DRAINAGE

- A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a **6-inch (150-mm)** course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of **12 inches (300 mm)** of filter material, placed in compacted layers **6 inches (150 mm)** thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least **6 inches (150 mm)**.
1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D698 with a minimum of two passes of a plate-type vibratory compactor.
- B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within **12 inches (300 mm)** of final subgrade, in compacted layers **6 inches (150 mm)** thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least **6 inches (150 mm)**.
1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D698 with a minimum of two passes of a plate-type vibratory compactor.
 2. Place and compact impervious fill over drainage backfill in **6-inch- (150-mm-)** thick compacted layers to final subgrade.

3.18 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 2. Place base course material over subbase course under hot-mix asphalt pavement.
 3. Shape subbase course and base course to required crown elevations and cross-slope grades.
 4. Place subbase course and base course **6 inches (150 mm)** or less in compacted thickness in a single layer.
 5. Place subbase course and base course that exceeds **6 inches (150 mm)** in compacted thickness in layers of equal thickness, with no compacted layer more than **6 inches (150 mm)** thick or less than **3 inches (75 mm)** thick.
 6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D698 ASTM D1557.
- C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least **12 inches (300 mm)** wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D698 ASTM D1557.

3.19 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course **6 inches (150 mm)** or less in compacted thickness in a single layer.
3. Place drainage course that exceeds **6 inches (150 mm)** in compacted thickness in layers of equal thickness, with no compacted layer more than **6 inches (150 mm)** thick or less than **3 inches (75 mm)** thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D698.

3.20 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
 2. Determine that fill material classification and maximum lift thickness comply with requirements.
 3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- E. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:
 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every **2000 sq. ft. (186 sq. m)** or less of paved area or building slab but in no case fewer than three tests.
 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every **100 feet (30 m)** or less of wall length but no fewer than two tests.
 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every **150 feet (46 m)** or less of trench length but no fewer than two tests.
- F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.
- B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
 - 1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 321216 - ASPHALT PAVING

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. Cold milling of existing asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt overlay.
5. Asphalt curbs.
6. Asphalt traffic-calming devices.
7. Asphalt surface treatments.

- B. Related Requirements:

1. Section 312000 "Earth Moving" for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
2. Section 321313 "Concrete Paving" for concrete pavement and for separate concrete curbs, gutters, and driveway aprons.
3. Section 321373 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.
4. Section 321400 "Unit Paving" for bituminous setting bed for pavers and for stone and precast concrete curbs.

1.3 UNIT PRICES

- A. Work of this Section is affected by contract bid price.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include technical data and tested physical and performance properties.
 - 2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
 - 3. Job-Mix Designs: For each job mix proposed for the Work.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and testing agency.
- B. Material Certificates: For each paving material. Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.
- C. Material Test Reports: For each paving material, by a qualified testing agency.
- D. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.
- B. Testing Agency Qualifications: Qualified according to ASTM D3666 for testing indicated.
- C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of MDOT for asphalt paving work.
 - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 - 1. Prime Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
 - 2. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
 - 3. Slurry Coat: Comply with weather limitations in ASTM D3910.
 - 4. Asphalt Base Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.
 - 5. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: ASTM D692/D692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D1073, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
 - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: ASTM D242/D242M, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: ASTM D6373 binder designation PG 64-22.
- B. Tack Coat: ASTM D977 emulsified asphalt, or ASTM D2397/D2397M cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- C. Water: Potable.
- D. Undersealing Asphalt: ASTM D3141/D3141M; pumping consistency.

2.3 AUXILIARY MATERIALS

- A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material, equal to performance of required hot-mix asphalt paving produced from all new materials.

2.4 MIXES

- A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:
 - 1. Leveling Course: MDOT 4E
 - 2. Surface Course: MDOT 5E
- B. Recycled Asphalt Pavement: The amount of RAP shall be limited to 15 percent in the leveling course and shall not be in the surface course.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to **3 mph (5 km/h)**.
 - 2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than **15 tons (13.6 tonnes)**.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

3.3 COLD MILLING

- A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
 - 1. Mill to a depth of **1-1/2 inches (38 mm)**.
 - 2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
 - 3. Control rate of milling to prevent tearing of existing asphalt course.
 - 4. Repair or replace curbs, driveway aprons, manholes, and other construction damaged during cold milling.
 - 5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
 - 6. Patch surface depressions deeper than **1 inch (25 mm)** after milling, before wearing course is laid.
 - 7. Handle milled asphalt material according to approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."
 - 8. Keep milled pavement surface free of loose material and dust.
 - 9. Do not allow milled materials to accumulate on-site.

3.4 PATCHING

- A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending **12 inches (300 mm)** into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

- B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseal concrete pieces firmly.
 - 1. Undersealing: Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseal pieces firmly.
 - 2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
- C. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of **0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m)**.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- D. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.
- E. Placing Patch Material: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.5 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than **1 inch (25 mm)** in existing pavements.
 - 1. Install leveling wedges in compacted lifts not exceeding **3 inches (75 mm)** thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of **1/4 inch (6 mm)**.
 - 1. Clean cracks and joints in existing hot-mix asphalt pavement.
 - 2. Use emulsified-asphalt slurry to seal cracks and joints less than **1/4 inch (6 mm)** wide. Fill flush with surface of existing pavement and remove excess.
 - 3. Use hot-applied joint sealant to seal cracks and joints more than **1/4 inch (6 mm)** wide. Fill flush with surface of existing pavement and remove excess.

3.6 SURFACE PREPARATION

- A. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
 - 1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

- C. Cutback Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
 - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 - 2. Protect primed substrate from damage until ready to receive paving.
- D. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth (0.5 to 1.40 L/sq. m per 25 mm depth). Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
 - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 - 2. Protect primed substrate from damage until ready to receive paving.
- E. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.7 PLACING HOT-MIX ASPHALT

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 - 2. Place hot-mix asphalt surface course in single lift.
 - 3. Spread mix at a minimum temperature of 250 deg F (121 deg C).
 - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
 - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.
 - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches (25 to 38 mm) from strip to strip to ensure proper compaction of mix along longitudinal joints.
 - 2. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.8 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
1. Clean contact surfaces and apply tack coat to joints.
 2. Offset longitudinal joints, in successive courses, a minimum of **6 inches (150 mm)**.
 3. Offset transverse joints, in successive courses, a minimum of **24 inches (600 mm)**.
 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.9 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
1. Complete compaction before mix temperature cools to **185 deg F (85 deg C)**.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
1. Average Density: 96 percent of reference laboratory density according to ASTM D6927, but not less than 94 percent or greater than 100 percent.
 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D2041/D2041M, but not less than 90 percent or greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.10 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus **1/2 inch (13 mm)**.
 - 2. Surface Course: Plus **1/4 inch (6 mm)**, no minus.

- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a **10-foot (3-m)** straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: **1/4 inch (6 mm)**.
 - 2. Surface Course: **1/8 inch (3 mm)**.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is **1/4 inch (6 mm)**.

- C. Asphalt Traffic-Calming Devices: Compact and form asphalt to produce the contour indicated and within a tolerance of plus or minus **1/8 inch (3 mm)** of height indicated above pavement surface.

3.11 SURFACE TREATMENTS

- A. Fog Seals: Apply fog seal at a rate of **0.10 to 0.15 gal./sq. yd. (0.45 to 0.7 L/sq. m)** to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.

- B. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D3910 and allow to cure.
 - 1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D3549/D3549M.

- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

- D. Asphalt Traffic-Calming Devices: Finished height of traffic-calming devices above pavement will be measured for compliance with tolerances.

- E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D979/D979M.
 - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D2041/D2041M, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D1188 or ASTM D2726/D2726M.

- a. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than three cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D1188 or ASTM D2726/D2726M.
- F. Replace and compact hot-mix asphalt where core tests were taken.
- G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.13 WASTE HANDLING

- A. General: Handle asphalt-paving waste according to approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

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 Concrete Paving.

1. Driveways.
2. Roadways.
3. Parking lots.
4. Curbs and gutters.
5. Walks.

- B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" Section 033053 "Miscellaneous Cast-in-Place Concrete" for general building applications of concrete.
2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
3. Section 321723 "Pavement Markings."

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to concrete paving, including but not limited to, the following:
 - a. Concrete mixture design.
 - b. Quality control of concrete materials and concrete paving construction practices.
2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
 - a. Contractor's superintendent.

- b. Independent testing agency responsible for concrete design mixtures.
- c. Ready-mix concrete manufacturer.
- d. Concrete paving Subcontractor.
- e. Manufacturer's representative of stamped concrete paving system used for stamped detectable warnings.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified ready-mix concrete manufacturer.
- B. Material Certificates: For the following, from manufacturer:
 - 1. Cementitious materials.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Fiber reinforcement.
 - 4. Admixtures.
 - 5. Curing compounds.
 - 6. Applied finish materials.
 - 7. Bonding agent or epoxy adhesive.
 - 8. Joint fillers.
- C. Material Test Reports: For each of the following:
 - 1. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
- D. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Stamped Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.
- B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- C. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

1.9 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
 1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 2. Do not use frozen materials or materials containing ice or snow.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- C. Hot-Weather Concrete Placement: Comply with ACI 301 (ACI 301M) and as follows when hot-weather conditions exist:
 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
 1. Use flexible or uniformly curved forms for curves with a radius of 100 feet (30.5 m) or less. Do not use notched and bent forms.

- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

- A. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from galvanized-steel wire into flat sheets.
- B. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.
- C. Epoxy-Coated Welded-Wire Reinforcement: ASTM A884/A884M, Class A, plain steel.
- D. Reinforcing Bars: ASTM A615/A615M, **Grade 60 (Grade 420)**; deformed.
- E. Galvanized Reinforcing Bars: ASTM A767/A767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A615/A615M, **Grade 60 (Grade 420)** deformed bars.
- F. Epoxy-Coated Reinforcing Bars: ASTM A775/A775M or ASTM A934/A934M; with ASTM A615/A615M, **Grade 60 (Grade 420)** deformed bars.
- G. Steel Bar Mats: ASTM A184/A184M; with ASTM A615/A615M, **Grade 60 (Grade 420)** deformed bars; assembled with clips.
- H. Plain-Steel Wire: ASTM A1064/A1064M, galvanized.
- I. Deformed-Steel Wire: ASTM A1064/A1064M.
- J. Epoxy-Coated-Steel Wire: ASTM A884/A884M, Class A; coated, plain.
- K. Joint Dowel Bars: ASTM A615/A615M, **Grade 60 (Grade 420)** plain-steel bars. Cut bars true to length with ends square and free of burrs.
- L. Epoxy-Coated, Joint Dowel Bars: ASTM A775/A775M; with ASTM A615/A615M, **Grade 60 (Grade 420)** plain-steel bars.
- M. Tie Bars: ASTM A615/A615M, **Grade 60 (Grade 420)**; deformed.
- N. Hook Bolts: **ASTM A307, Grade A (ASTM F568M, Property Class 4.6)**, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- O. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
- P. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

- Q. Zinc Repair Material: ASTM A780/A780M.

2.4 CONCRETE MATERIALS

- A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
1. Portland Cement: ASTM C150/C150M, portland cement Type I.
 2. Fly Ash: ASTM C618, Class C or Class F.
- B. Normal-Weight Aggregates: ASTM C33/C33M, uniformly graded. Provide aggregates from a single source.
1. Maximum Coarse-Aggregate Size: **1 inch (25 mm)** nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Air-Entraining Admixture: ASTM C260/C260M.
- D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 2. Retarding Admixture: ASTM C494/C494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
- E. Water: Potable and complying with ASTM C94/C94M.

2.5 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately **9 oz./sq. yd. (305 g/sq. m)** dry.
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

2.6 RELATED MATERIALS

- A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber in preformed strips.
- B. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.7 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to **ACI 301 (ACI 301M)**, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
 - 2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash or Pozzolan: 25 percent.
 - 2. Slag Cement: 50 percent.
 - 3. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 6 percent plus or minus 1-1/2 percent for **1-inch (25-mm)** nominal maximum aggregate size.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing 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.
- F. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than **1.0 lb/cu. yd. (0.60 kg/cu. m)**.
- G. Concrete Mixtures: Normal-weight concrete.
 - 1. Compressive Strength (28 Days): **4000 psi (27.6 MPa)**.
 - 2. Maximum W/C Ratio at Point of Placement: 0.45.
 - 3. Slump Limit: **5 inches (125 mm)**, plus or minus **1 inch (25 mm)**.

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M and ASTM C1116/C1116M. Furnish batch certificates for each batch discharged and used in the Work.
 - 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.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.
 1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph (5 km/h).
 2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
 3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch (13 mm) according to requirements in Section 312000 "Earth Moving."
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

- D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.
- F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D3963/D3963M.
- G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum **2-inch (50-mm)** overlap of adjacent mats.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
 - 2. Provide tie bars at sides of paving strips where indicated.
 - 3. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals as indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than **1/2 inch (13 mm)** or more than **1 inch (25 mm)** below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - 6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a **3/8-inch (10-mm)** radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a **3/8-inch (10-mm)** radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with **ACI 301 (ACI 301M)** requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to **ACI 301 (ACI 301M)** by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.
- H. Screed paving surface with a straightedge and strike off.
- I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.
- K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
 - 1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
 - 2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
 - 3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface **1/16 to 1/8 inch (1.6 to 3 mm)** deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 SPECIAL FINISHES

- A. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in paving surface as follows:
 - 1. Immediately after float finishing, spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
 - 2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
 - 3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
 - 4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.
- B. Seeded Exposed-Aggregate Finish: Immediately after initial floating, spread a single layer of aggregate uniformly on paving surface. Tamp aggregate into plastic concrete and float finish to entirely embed aggregate with mortar cover of **1/16 inch (1.6 mm)**.
 - 1. Spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
 - 2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.
 - 3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
 - 4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

3.9 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching $0.2 \text{ lb/sq. ft.} \times h$ ($1 \text{ kg/sq. m} \times h$) 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.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by curing compound as follows:
 - 1. 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.

3.10 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 (ACI 117M) and as follows:
 - 1. Elevation: $3/4 \text{ inch}$ (19 mm).
 - 2. Thickness: Plus $3/8 \text{ inch}$ (10 mm), minus $1/4 \text{ inch}$ (6 mm).
 - 3. Surface: Gap below 10-feet- (3-m-) long; unlevelled straightedge not to exceed $1/2 \text{ inch}$ (13 mm).
 - 4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: $1/2 \text{ inch per } 12 \text{ inches}$ ($13 \text{ mm per } 300 \text{ mm}$) of tie bar.
 - 5. Lateral Alignment and Spacing of Dowels: 1 inch (25 mm).
 - 6. Vertical Alignment of Dowels: $1/4 \text{ inch}$ (6 mm).
 - 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: $1/4 \text{ inch per } 12 \text{ inches}$ ($6 \text{ mm per } 300 \text{ mm}$) of dowel.
 - 8. Joint Spacing: 3 inches (75 mm).
 - 9. Contraction Joint Depth: Plus $1/4 \text{ inch}$ (6 mm), no minus.
 - 10. Joint Width: Plus $1/8 \text{ inch}$ (3 mm), no minus.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage Engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when it is 80 deg F (27 deg C) and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
- D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- G. Concrete paving will be considered defective if it does not pass tests and inspections.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- I. Prepare test and inspection reports.

3.12 REPAIR AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 32 17 23 - PAVEMENT MARKINGS

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 painted markings applied to asphalt and concrete pavement.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include technical data and tested physical and performance properties.
- B. Shop Drawings: For pavement markings.
 - 1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
- C. Samples: For each exposed product and for each color and texture specified; on rigid backing, 8 inches square.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of 2020 MDOT Standard Specifications for Construction.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 PAVEMENT-MARKING PAINT

- A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
 - 1. Color:
 - a. Parking: Yellow
 - b. Barrier Free Parking: Blue
 - c. Pedestrian Crossings: Yellow

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.
- B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Landscape Architect or Engineer.
- B. Latex Paint shall be applied in two (2) coats.
- C. Allow paving to age for a minimum of 24 hours before starting first coat of pavement marking.
- D. Sweep and clean surface to eliminate loose material and dust.
- E. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
 - 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.

3.3 PROTECTING AND CLEANING

- A. Protect pavement markings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 32 17 23

SECTION 323113 - CHAIN LINK FENCES AND GATES

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. Chain-link fences.
- 2. Horizontal-slide gates.
- 3. Privacy slats.

- B. Related Requirements:

- 1. Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
- 2. Review sequence of operation for each type of gate operator.
- 3. Review coordination of interlocked equipment specified in this Section and elsewhere.
- 4. Review required testing, inspecting, and certifying procedures.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Fence and gate posts, rails, and fittings.
 - b. Chain-link fabric, reinforcements, and attachments.
 - c. Accessories: Barbed wire.
 - d. Gates and hardware.
 - e. Gate operators, including operating instructions and motor characteristics.

- B. Shop Drawings: For each type of fence and gate assembly.

- 1. Include plans, elevations, sections, details, and attachments to other work.
- 2. Include accessories, hardware, gate operation, and operational clearances.

3. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
 4. Wiring Diagrams: For power, signal, and control wiring.
- C. Samples for Initial Selection: For each type of factory-applied finish.
 - D. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:
 1. Polymer-Coated Components: In 6-inch (150-mm) lengths for components and on full-sized units for accessories.
 - E. Delegated-Design Submittal: For structural performance of chain-link fence and gate frameworks, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For factory-authorized service representative.
 - B. Product Certificates: For each type of chain-link fence and gate.
 - C. Product Test Reports: For framework strength according to ASTM F1043, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
 - D. Field quality-control reports.
 - E. Sample Warranty: For special warranty.
- 1.6 CLOSEOUT SUBMITTALS
- A. Operation and Maintenance Data: For gate operators to include in emergency, operation, and maintenance manuals.
- 1.7 QUALITY ASSURANCE
- A. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.
 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
 - B. Emergency Access Requirements: According to requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.
- 1.8 FIELD CONDITIONS
- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Failure to comply with performance requirements.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - c. Faulty operation of gate operators and controls.
 2. Warranty Period: Five 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 chain-link fence and gate frameworks.
- B. Structural Performance: Chain-link fence and gate frameworks shall withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated according to ASCE/SEI 7.
- C. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.

2.2 FENCE FRAMEWORK

- A. Posts and Rails: ASTM F1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F1043 or ASTM F1083 based on the following:
1. Fence Height: As indicated on Drawings.
 2. Heavy-Industrial-Strength Material: Group IA, round steel pipe, Schedule 40.
 - a. Line Post: 2.375 inches (60 mm) in diameter.
 - b. End, Corner, and Pull Posts: 2.875 inches (73 mm) in diameter.
 3. Horizontal Framework Members: top and bottom rails according to ASTM F1043.
 4. Brace Rails: ASTM F1043.
 5. Metallic Coating for Steel Framework:
 - a. External, Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil- (0.0076-mm-) thick, zinc-pigmented coating.

- B. Post Brace Rails - Match round steel pipe requirements for coating, strength, and stiffness. Provide brace rail with truss rod assembly for each gate, end, and pull post. Provide two brace rails extending in opposing directions, each truss rod assembly, for each corner post and for pull posts. Provide rail ends and clamps for attaching rails to posts.

2.3 TENSION WIRE

- A. Metallic-Coated Steel Wire: 0.177-inch- (4.5-mm-) diameter, marcelled tension wire according to ASTM A817 or ASTM A824, with the following metallic coating:
 - 1. Type II: Zinc coated (galvanized) by hot-dip electrolytic process, with the following minimum coating weight:
 - a. Matching chain-link fabric coating weight.

2.4 HORIZONTAL-SLIDE GATES

- A. General: ASTM F1184 for gate posts and single sliding gate types.
 - 1. Classification: Type II Cantilever Slide, Class 1 with external roller assemblies.
 - a. Gate Frame Width and Height: As indicated on drawings.
- B. Pipe and Tubing:
 - 1. Zinc-Coated Steel: Protective coating and finish to match fence framework.
 - 2. Gate Posts: ASTM F1184. Provide round tubular steel posts.
 - 3. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: Welded.
- D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame 12 inches (300 mm) as required to attach barbed wire assemblies.
- E. Overhead Track Assembly: Manufacturer's standard track, with overhead framework supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.
- F. Hardware:
 - 1. Hangers, Roller Assemblies, and Stops: Fabricated from galvanized steel.
 - 2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
 - 3. Lock: Manufacturer's standard internal device.
 - 4. Padlock and Chain: as shown on the drawings.

2.5 FITTINGS

- A. Provide fittings according to ASTM F626.
- B. Post Caps: Provide for each post.

1. Provide line post caps with loop to receive tension wire or top rail.
- C. Rail and Brace Ends: For each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
 1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches (152 mm) long.
 2. Rail Clamps: Line and corner boulevard clamps for connecting bottom rails to posts.
- E. Tension and Brace Bands: Pressed steel.
- F. Tension Bars: Steel, length not less than 2 inches (50 mm) shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.
- H. Barbed Wire Arms: Pressed steel or cast iron, with clips, slots, or other means for attaching strands of barbed wire, and means for attaching to posts, integral with post cap, for each post unless otherwise indicated.
- I. Tie Wires, Clips, and Fasteners: According to ASTM F626.
 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:
 - a. Hot-Dip Galvanized Steel: 0.148-inch- (3.76-mm-) diameter wire.
- J. Finish:
 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. (366 g/sq. m) of zinc.
 - a. Polymer coating over metallic coating.

2.6 BARBED WIRE

- A. Steel Barbed Wire: ASTM A121, two-strand barbed wire, 0.099-inch- (2.51-mm-) diameter line wire with 0.080-inch- (2.03-mm-) diameter, four-point round barbs spaced not more than 5 inches (127 mm) o.c.
 1. Zinc Coating: Type Z, Class 3.

2.7 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching,

and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a certified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 - 1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of **500 feet (152 m)** or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN-LINK FENCE INSTALLATION

- A. Install chain-link fencing according to ASTM F567 and more stringent requirements specified.
 - 1. Install fencing on established boundary lines inside property line.
- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Exposed Concrete: Extend **2 inches (50 mm)** above grade; shape and smooth to shed water.
- D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 30 degrees or more. For runs exceeding **500 feet (152 m)**, space pull posts an equal distance between corner or end posts.
- E. Line Posts: Space line posts uniformly at **10 feet (3 m)** o.c.

- F. Tension Wire: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- (3.05-mm-) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (610 mm) o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
1. Extended along top of barbed wire arms and top of fence fabric to support barbed tape.
 2. Top Tension Wire - Install tension wire through post cap loops and tie to each post cap loop with same gage and type of wire.
 3. Bottom Tension Wire - Install tension wire within 6" of bottom of fabric and tie to each post with same gage and type of wire.
- G. Top Rail: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- H. Intermediate and Bottom Rails: Secure to posts with fittings.
- I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2-inch (50-mm) bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches (380 mm) o.c.
- K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F626. Bend ends of wire to minimize hazard to individuals and clothing.
1. Maximum Spacing: Tie fabric to line posts at 12 inches (300 mm) o.c. and to braces at 24 inches (610 mm) o.c.
- L. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.
- M. Barbed Wire: Install barbed wire uniformly spaced, angled toward security side of fence as indicated on Drawings. Pull wire taut, install securely to extension arms, and secure to end post or terminal arms.
- N. Barbed Tape: Install according to ASTM F1911. Install barbed tape uniformly in configurations indicated and fasten securely to prevent movement or displacement.
- 3.4 GATE INSTALLATION
- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.5 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 323113

SECTION 329113 - SOIL PREPARATION

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 planting soils specified by composition of the mixes.
- B. Related Requirements:
 - 1. Section 311000 "Site Clearing" for topsoil stripping and stockpiling.
 - 2. Section 329200 "Turf and Grasses" for placing planting soil for turf and grasses.

1.3 ALLOWANCES

- A. Preconstruction testing is part of testing and inspecting allowance.

1.4 DEFINITIONS

- A. AAPFCO: Association of American Plant Food Control Officials.
- B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.
- C. CEC: Cation exchange capacity.
- D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.
- E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.
- F. Imported Soil: Soil that is transported to Project site for use.
- G. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.
- H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.
- I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.

- J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."
- K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.
- M. SSSA: Soil Science Society of America.
- N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- O. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- P. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- Q. USCC: U.S. Composting Council.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include recommendations for application and use.
 - 2. Include test data substantiating that products comply with requirements.
 - 3. Include sieve analyses for aggregate materials.
 - 4. Material Certificates: For each type of imported soil and soil amendment and fertilizer before delivery to the site, according to the following:
 - a. Manufacturer's qualified testing agency's certified analysis of standard products.
 - b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
 - c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For each testing agency.
- B. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

- C. Field quality-control reports.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil imported soil.
- B. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.
 - 1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.10 SOIL-SAMPLING REQUIREMENTS

- A. General: Extract soil samples according to requirements in this article.
- B. Sample Collection and Labeling: Have samples taken and labeled by state-certified, -licensed, or -registered soil scientist under the direction of the testing agency.
 - 1. Number and Location of Samples: Minimum of 2 representative soil samples from varied locations for each soil to be used or amended for landscaping purposes.
 - 2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."
 - 3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.
 - 4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.11 TESTING REQUIREMENTS

- A. General: Perform tests on soil samples according to requirements in this article.
- B. Physical Testing:
 - 1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":
 - a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
 - b. Hydrometer Method: Report percentages of sand, silt, and clay.

2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D698 (Standard Proctor).

C. Chemical Testing:

1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1- Physical and Mineralogical Methods."
3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

D. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."

E. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.

1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. (100 sq. m) for 6-inch (150-mm) depth of soil.
2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. (100 sq. m) for 6-inch (150-mm) depth of soil.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Do not move or handle materials when they are wet or frozen.
4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 PLANTING SOILS

- A. Per Section 815 of the MDOT 2020 Standard Specifications for Construction.

2.2 FERTILIZERS

- A. Per Section 815 of the MDOT 2020 Standard Specifications for Construction.

PART 3 - EXECUTION

3.1 GENERAL

- A. Place planting soil and fertilizers according to requirements in other Specification Sections.
- B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.

3.2 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

- A. General: Apply and mix un-amended soil with amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Subgrade Preparation: Till subgrade to a minimum depth of 4 inches (100 mm). Remove stones larger than 2 inches (50 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
- C. Compaction: Compact each blended lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698 and tested in-place.
- D. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections:
 - 1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D 698. Space tests at no less than one for each 1000 sq. ft. of in-place soil or part thereof.
- C. Soil will be considered defective if it does not pass tests and inspections.
- D. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.4 PROTECTION AND CLEANING

- A. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."
- B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Vehicle traffic.
 - 4. Foot traffic.
 - 5. Erection of sheds or structures.
 - 6. Impoundment of water.
 - 7. Excavation or other digging unless otherwise indicated.
- C. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.
 - 1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION 329113

SECTION 32 92 00 – TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Applicable provisions of this Section for this project Includes:

1. Hydro-Seeding.
2. Fertilizing

1.2 DEFINITIONS

- A. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- B. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 32 91 13 "Soil Preparation" and drawing designations for planting soils.

1.3 INFORMATIONAL SUBMITTALS

- A. Certification of grass seed.
1. Certification of each seed mixture for turfgrass sod.
- B. Product certificates.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.
1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 2. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:
 - a. Landscape Industry Certified Technician - Exterior.
 - b. Landscape Industry Certified Lawncare Manager.
 - c. Landscape Industry Certified Lawncare Technician.
 3. Pesticide Applicator: State licensed, commercial.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.
- B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.

PART 2 - PRODUCTS

2.1 SEED

- A. Seeded Lawn Mix

<u>Seed Type</u>	<u>Proportion</u>	<u>Min. Purity</u>	<u>Germination</u>
Merit KY Bluegrass	25%	90%	80%
Touchdown KY Bluegrass	20%	90%	80%
Pennfine Perennial Rye	20%	95%	80%
Creeping Red Fescue	35%	90%	80%

2.2 FERTILIZERS

- A. Commercial Fertilizer: MDOT Class A

PART 3 - EXECUTION

3.1 TURF AREA PREPARATION

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 32 91 13 "Soil Preparation."
- B. Moisten prepared area before applying the mulch blanket if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.2 SEEDING

- A. Seed and mulch shall be applied by an approved hydro-seeding operation.

3.3 TURF MAINTENANCE

- A. No maintenance by the Contractor is required after hydro-seeding is complete. The Contractor shall furnish the facility with one 25 pound bag of the specified lawn seed.

END OF SECTION 32 92 00

SECTION 334200 - STORMWATER CONVEYANCE

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. Concrete pipe and fittings.
 2. Non-pressure transition couplings.
 3. Backwater valves.
 4. Cleanouts.
 5. Drains.
 6. Manholes.
 7. Catch basins.
 8. Stormwater inlets.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 1. Manholes: Include plans, elevations, sections, details, frames, and covers.
 2. Catch basins stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.
- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.

- C. Handle manholes in accordance with manufacturer's written rigging instructions.
- D. Handle catch basins and stormwater inlets in accordance with manufacturer's written rigging instructions.

1.7 FIELD CONDITIONS

- A. Interruption of Existing Storm Drainage 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 in accordance with requirements indicated:
 - 1. Notify Owner no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.1 ABS PIPE AND FITTINGS

- A. Source Limitations: Obtain ABS pipe and fittings from single manufacturer.
- B. NSF Marking: Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.
- C. Solid-Wall ABS Pipe: ASTM D2661, Schedule 40.
- D. Cellular-Core ABS Pipe: ASTM F628, Schedule 40.
- E. ABS Socket Fittings: ASTM D2661, made to ASTM D3311, drain, waste, and vent patterns.
- F. Gaskets: ASTM F477, elastomeric seals.

2.2 PVC PIPE AND FITTINGS

- A. Source Limitations: Obtain PVC pipe and fittings from single manufacturer.
- B. NSF Marking: Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.
- C. PVC Corrugated Sewer Piping:
 - 1. Pipe: ASTM F949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
 - 2. Fittings: ASTM F949, PVC molded or fabricated, socket type.
 - 3. Gaskets: ASTM F477, elastomeric seals.
- D. PVC Profile Sewer Piping:
 - 1. Pipe: ASTM F794, PVC profile, gravity sewer pipe with bell-and-spigot ends for gasketed joints.
 - 2. Fittings: ASTM D3034, PVC with bell ends.

3. Gaskets: ASTM F477, elastomeric seals.

E. PVC Gravity Sewer Piping:

1. Pipe and Fittings: ASTM F679, T-1 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F477, elastomeric seals for gasketed joints.

2.3 CONCRETE PIPE AND FITTINGS

- A. Source Limitations: Obtain concrete pipe and fittings from single manufacturer.

- B. Reinforced-Concrete Sewer Pipe and Fittings: **ASTM C76** (**ASTM C76M**).

1. Bell-and-spigot ends and gasketed joints with **ASTM C443** (**ASTM C443M**), rubber gaskets
2. Class IV.

2.4 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
2. For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

1. Source Limitations: Obtain unshielded, flexible couplings from single manufacturer.
2. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, Flexible Couplings:

1. Source Limitations: Obtain shielded, flexible couplings from single manufacturer.
2. Description: ASTM C1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

2.5 CLEANOUTS

A. PVC Cleanouts:

1. Source Limitations: Obtain PVC cleanouts from single manufacturer.
2. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.6 MANHOLES

- A. Standard Precast Concrete Manholes:

1. Description: **ASTM C478 (ASTM C478M)**, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: **48 inches (1200 mm)** minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: **6-inch (150-mm)** minimum thickness for floor slab and **4-inch (102-mm)** minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: **4-inch (102-mm)** minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: **ASTM C990 (ASTM C990M)**, bitumen or butyl rubber.
8. Resilient Pipe Connectors: **ASTM C923 (ASTM C923M)**, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps; FRP ladder; or ASTM A615/A615M, deformed, **1/2-inch (13-mm)** steel reinforcing rods encased in ASTM D4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at **12- to 16-inch (300- to 400-mm)** intervals. Omit steps if total depth from floor of manhole to finished grade is less than **60 (1500) inches (mm)**.
10. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, **6- to 9-inch (150- to 225-mm)** total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:

1. Description: Ferrous; **24-inch (610-mm)** ID by **7- to 9-inch (175- to 225-mm)** riser with **4-inch- (102-mm-)** minimum width flange and **26-inch- (660-mm-)** diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A536, Grade 60-40-18 ductile iron unless otherwise indicated.

2.7 CONCRETE

A. General: Cast-in-place concrete in accordance with **ACI 318 (ACI 318M)**, **ACI 350 (ACI 350M)**, and the following:

1. Cement: ASTM C150/C150M, Type II.
2. Fine Aggregate: ASTM C33/C33M, sand.
3. Coarse Aggregate: ASTM C33/C33M, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: **4000 psi (27.6 MPa)** minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.

- C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, **4000 psi (27.6 MPa)** minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
 - 1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - a. Invert Slope: 1 percent through manhole.
 - 2. Benches: Concrete, sloped to drain into channel.
 - a. Slope: 4 percent.
- D. Ballast and Pipe Supports: Portland cement design mix, **3000 psi (20.7 MPa)** minimum, with 0.58 maximum water/cementitious materials ratio.
 - 1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
 - 2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.

2.8 CATCH BASINS

- A. Standard Precast Concrete Catch Basins:
 - 1. Description: **ASTM C478 (ASTM C478M)**, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 - 2. Base Section: **6-inch (150-mm)** minimum thickness for floor slab and **4-inch (102-mm)** minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
 - 3. Riser Sections: **4-inch (102-mm)** minimum thickness, **48-inch (1200-mm)** diameter, and lengths to provide depth indicated.
 - 4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 - 5. Joint Sealant: **ASTM C990 (ASTM C990M)**, bitumen or butyl rubber.
 - 6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
 - 7. Grade Rings: Include two or three reinforced-concrete rings, of **6- to 9-inch (150- to 225-mm)** total thickness, that match **24-inch- (610-mm-)** diameter frame and grate.
 - 8. Steps: Individual FRP steps; FRP ladder; or ASTM A615/A615M, deformed, **1/2-inch (13-mm)** steel reinforcing rods encased in ASTM D4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at **12- to 16-inch (300- to 400-mm)** intervals. Omit steps if total depth from floor of catch basin to finished grade is less than **60 (1500) inches (mm)**.
 - 9. Pipe Connectors: **ASTM C923 (ASTM C923M)**, resilient, of size required, for each pipe connecting to base section.
- B. Frames and Grates: ASTM A536, Grade 60-40-18, ductile iron designed for A-16 (AASHTO HS20-44), structural loading. Include flat grate with small square or short-slotted drainage openings.
 - 1. Size: **24 by 24 inches (610 by 610 mm)** minimum unless otherwise indicated.
 - 2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- F. Install gravity-flow, nonpressure drainage piping in accordance with the following:
 - 1. Install piping pitched down in direction of flow.
 - 2. Install piping **NPS 6 (DN 150)** and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
 - 3. Install piping with **36- (915-) inch- (mm-)** minimum cover.
 - 4. Install hub-and-spigot, cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
 - 5. Install hubless cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
 - 6. Install ductile-iron piping and special fittings in accordance with AWWA C600 or AWWA M41.
 - 7. Install corrugated-steel piping in accordance with ASTM A798/A798M.
 - 8. Install corrugated-aluminum piping in accordance with ASTM B788/B788M.
 - 9. Install ABS sewer piping in accordance with ASTM D2321 and ASTM F1668.
 - 10. Install PE corrugated sewer piping in accordance with ASTM D2321.
 - 11. Install PVC cellular-core piping in accordance with ASTM D2321 and ASTM F1668.
 - 12. Install PVC sewer piping in accordance with ASTM D2321 and ASTM F1668.
 - 13. Install PVC profile gravity sewer piping in accordance with ASTM D2321 and ASTM F1668.
 - 14. Install PVC water-service piping in accordance with ASTM D2321 and ASTM F1668.
 - 15. Install fiberglass sewer piping in accordance with ASTM D3839 and ASTM F1668.
 - 16. Install nonreinforced-concrete sewer piping in accordance with ASTM C1479 and ACPA's "Concrete Pipe Installation Manual."

17. Install reinforced-concrete sewer piping in accordance with ASTM C1479 and ACPA's "Concrete Pipe Installation Manual."
- G. Install corrosion-protection piping encasement over the following underground metal piping in accordance with ASTM A674 or AWWA C105/A21.5:
1. Hub-and-spigot, cast-iron soil pipe and fittings.
 2. Hubless cast-iron soil pipe and fittings.
 3. Ductile-iron pipe and fittings.
 4. Expansion joints and deflection fittings.

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping in accordance with the following:
1. Join hub-and-spigot, cast-iron soil piping with gasketed joints in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
 2. Join hub-and-spigot, cast-iron soil piping with caulked joints in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum caulked joints.
 3. Join hubless cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
 4. Join ductile-iron culvert piping in accordance with AWWA C600 for push-on joints.
 5. Join ductile-iron piping and special fittings in accordance with AWWA C600 or AWWA M41.
 6. Join corrugated-steel sewer piping in accordance with ASTM A798/A798M.
 7. Join corrugated-aluminum sewer piping in accordance with ASTM B788/B788M.
 8. Join ABS sewer piping in accordance with ASTM D2321 for elastomeric-seal joints.
 9. Join corrugated-PE piping in accordance with ASTM D3212 for push-on joints.
 10. Join PVC cellular-core piping in accordance with ASTM D2321 and ASTM F891 for solvent-cemented joints.
 11. Join PVC corrugated sewer piping in accordance with ASTM D2321 for elastomeric-seal joints.
 12. Join PVC sewer piping in accordance with ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasketed joints.
 13. Join PVC profile gravity sewer piping in accordance with ASTM D2321 for elastomeric-seal joints or ASTM F794 for gasketed joints.
 14. Join fiberglass sewer piping in accordance with ASTM D3839 for elastomeric-seal joints.
 15. Join nonreinforced-concrete sewer piping in accordance with ASTM C14 (ASTM C14M) and ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
 16. Join reinforced-concrete sewer piping in accordance with ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
 17. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
1. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
- B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 (450 by 450 by 300) inches (mm) deep. Set with tops at surrounding earth grade.

- C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants in accordance with ASTM C891.
- C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops flush with finished surface elsewhere unless otherwise indicated.

3.6 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

3.7 CONCRETE PLACEMENT

- A. Place cast-in-place concrete in accordance with **ACI 318 (ACI 318M)**.

3.8 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Section 221413 "Facility Storm Drainage Piping."
- B. Connect force-main piping to building's storm drainage force mains specified in Section 221413 "Facility Storm Drainage Piping." Terminate piping where indicated.
- C. Make connections to existing piping and underground manholes.
 - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus **6-inch (150-mm)** overlap, with not less than **6 inches (150 mm)** of concrete with 28-day compressive strength of **3000 psi (20.7 MPa)**.
 - 2. Make branch connections from side into existing piping, **NPS 4 to NPS 20 (DN 100 to DN 500)**. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than **6 inches (150 mm)** of concrete with 28-day compressive strength of **3000 psi (20.7 MPa)**.
 - 3. Make branch connections from side into existing piping, **NPS 21 (DN 525)** or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow **3 inches (76 mm)** of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in **6 inches (150 mm)** of concrete for minimum length of **12 inches (300 mm)** to provide additional support of collar from connection to undisturbed ground.

- a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi (20.7 MPa) unless otherwise indicated.
 - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- D. Connect to sediment interceptors specified in Section 221323 "Sanitary Waste Interceptors."
- E. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
 - a. Shielded flexible couplings for same or minor difference OD pipes.
 - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
 2. Use pressure-type pipe couplings for force-main joints.

3.9 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
1. Close open ends of piping with at least 8- (203-) inch- (mm-) thick, brick masonry bulkheads.
 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
1. Remove manhole or structure and close open ends of remaining piping.
 2. Remove top of manhole or structure down to at least 36 (915) inches (mm) below final grade. Fill to within 12 (300) inches (mm) of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
- C. Backfill to grade in accordance with Section 312000 "Earth Moving."

3.10 IDENTIFICATION

- A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
1. Use detectable warning tape over ferrous piping.

2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.11 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately **24 inches (610 mm)** of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems in accordance with requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test in accordance with requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
 - b. Option: Test plastic piping in accordance with ASTM F1417.

- C. Leaks and loss in test pressure constitute defects that must be repaired.

- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION 334200

APPENDIX I

SPECIAL WORKING CONDITIONS

None

APPENDIX II
SPECIAL PROJECT PROCEDURES

HAZARDOUS MATERIALS PROJECT PROCEDURES

1. The Contractor must 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 must immediately stop all affected work, give written notice to the Owner of the conditions encountered, and take appropriate health and safety precautions.
2. This project has been identified by the DTMB-SFA as having a possibility of containing Hazardous Waste materials to be legally removed from the Project job site in order to complete the Work as described in the Proposal And Contract. If removal of friable asbestos material is required, the Contractor must contact the Air Quality Division, Department of Environment, Great Lakes, and Energy, at (517) 284-6773, for a permit and furnish all training, labor, materials, services, insurance, and equipment necessary to carry out the removal operations of all Hazardous Materials from the Project job site, as identified by the Scope of Work, or encountered on the Project job site, in accordance with State and Federal Hazardous Waste Codes. A Contract Change Order will be written to modify the existing Contract to pay for the additional cost.
3. Environmental Hazards (air, water, land and liquid industrial) are handled by the Waste and Hazardous Materials Division, Michigan Department of Environment, Great Lakes, and Energy (EGLE) in carrying out the requirements of the Federal Environmental Protection Agency (EPA). For general information and/or a copy of the latest regulations and publications call (517) 335-2690.
4. The Michigan Occupational Safety and Health Administration (MIOSHA) provides protection and regulations for the safety and health of workers. The Department of Licensing and Regulatory Affairs provides for the safety of workers. The Department of Health & Human Services provides for the health of workers (517/373-3740) (TDD 517/373-3573).
 - 4.1 Contractor must post any applicable State and/or Federal government regulations at the job site in a prominent location.
 - 4.2 Contractor must be responsible for training their workers in safe work practices and in proper removal methods when coming in contact with hazardous chemicals.
5. Applicable Regulations:
 - 5.1 Natural Resources and Environmental Protection Act – PA 451 of 1994, as amended, including Part 111 – Hazardous Waste Management, Part 121 – Liquid Industrial Waste and Part 147 – PCB compounds.
 - 5.2 RCRA, 1976 - Resource Conservation and Recovery Act: This federal statute regulates generation, transportation, treatment, storage, or disposal of hazardous wastes nationally.
 - 5.3 TSCA, 1979 – Toxic Substances Control Act: This statute regulates the generation, transportation, storage, and disposal of industrial chemicals such as PCBs.
6. Definitions: Hazardous substances are ignitable, corrosive, reactive, and/or toxic, based on their chemical characteristics.
 - 6.1 Under Federal and Michigan Law, a Small Quantity Generator of hazardous waste provides from 220 to less than 2,000 lbs./month or never accumulates 2,200 lbs. or more.
 - 6.2 A Generator size provider of hazardous waste provides 2,200 lbs. or more/month or accumulates above 2,200 lbs.
7. Disposals: To use an off-site hazardous waste disposal facility, the Contractor must use the Uniform Hazardous Waste Manifest (shipping paper). Small quantities of hazardous waste may not be disposed of in sanitary landfills used for solid waste.
8. Federal, state, and local Laws and regulations may apply to the storage, handling and disposal of Hazardous Materials and wastes at each State Agency. Contact the **Environmental Assistance Center** of the Michigan Department of Environment, Great Lakes, and Energy (EGLE) at **1-800-662-9278**, Fax to: 517-241-0673 or e-mail to: DEQ-EAD-env-assist@michigan.gov for general EGLE information including direct and referral assistance on air, water and wetlands permits; contaminated site clean-ups; underground storage tank removals and remediation; hazardous and solid waste disposal; pollution prevention and recycling; and compliance-related assistance. The Center provides businesses, municipalities, and the general public with a single point of access to EGLE's environmental programs.

APPENDIX III

**STATE OF MICHIGAN PREVAILING WAGE SCHEDULES AND
FEDERAL PROVISIONS ADDENDUM
& WAGE RATE SCHEDULES**

"General Decision Number: MI20240090 07/26/2024

Superseded General Decision Number: MI20230090

State: Michigan

Construction Type: Building

County: Livingston County in Michigan.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

<p>If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:</p>	<ul style="list-style-type: none"> . Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least \$17.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2024.
<p>If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:</p>	<ul style="list-style-type: none"> . Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least \$12.90 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2024.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

Modification Number	Publication Date
0	01/05/2024
1	01/19/2024
2	04/05/2024

3	04/19/2024
4	05/31/2024
5	07/05/2024
6	07/12/2024
7	07/19/2024
8	07/26/2024

ASBE0047-002 07/01/2023

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR.....	\$ 36.62	19.78

BOIL0169-001 01/01/2024

	Rates	Fringes
BOILERMAKER.....	\$ 39.65	35.68

BRMI0009-004 08/01/2023

Townships of Conway, Handy, Iosco & Unadilla

	Rates	Fringes
BRICKLAYER.....	\$ 34.89	25.43
TILE FINISHER.....	\$ 22.78	15.66
TILE SETTER.....	\$ 26.38	18.09

FOOTNOTE:

Paid Holiday: Fourth of July, if the worker was employed by the contractor in any period of seven working days before said holiday within the current calendar year.

BRMI0009-020 06/01/2023

Townships of Brighton, Cohoctah, Deerfield, Genoa, Green Oak, Hamburg, Hartland, Howell, Marion, Osceola, Putnam & Tyrone

	Rates	Fringes
BRICKLAYER.....	\$ 38.38	25.26
TILE FINISHER.....	\$ 31.88	23.29
TILE SETTER.....	\$ 38.99	23.31

FOOTNOTE:

Paid Holiday: Fourth of July, if the worker was employed by the contractor in any period of seven days before said holiday within the current calendar year.

CARP0687-002 06/01/2023

Remainder of County

	Rates	Fringes
CARPENTER (Including Acoustical Ceiling Installation, Drywall Hanging, Form Work, Metal Stud Installation & Scaffold Building).....	\$ 40.98	30.22

* CARP1004-003 06/01/2024

Townships of Cohoctah, Conway, Handy, Howell, Iosco & Marion

	Rates	Fringes
CARPENTER (Including Acoustical Ceiling Installation, Drywall		

Hanging, Form Work, Metal
 Stud Installation & Scaffold
 Building).....\$ 33.51 21.06

 * CARP1004-006 06/01/2024
 Townships of Cohoctah, Conway, Handy, Howell, Iosco & Marion
 Rates Fringes

CARPENTER (Floor Layer -
 Carpet, Resilient & Vinyl
 Flooring).....\$ 33.51 21.06

 * CARP1045-002 06/01/2024
 Remainder of County
 Rates Fringes

CARPENTER (Floor Layer -
 Carpet, Resilient, & Vinyl
 Flooring).....\$ 34.09 20.81

 * CARP1102-002 06/01/2024
 Rates Fringes
 MILLWRIGHT.....\$ 36.47 40.52

 ELEC0058-003 07/02/2020
 Townships of Brighton, Deerfield, Genoa, Hartland, Oceola &
 Tyrone
 Rates Fringes

ELECTRICIAN
 Low Voltage Wiring & Alarm
 Installation
 Installer.....\$ 29.60 13.94
 Technician.....\$ 36.89 14.16

 ELEC0252-002 06/01/2020
 Townships of Green Oak, Hamburg, Putnam and Unadilla
 Rates Fringes

ELECTRICIAN
 Alarm Installation & Low
 Voltage Wiring.....\$ 32.13 16.42

 ELEC0665-008 05/31/2022
 Townships of Cohoctah, Conway, Handy, Howell, Iosco and Marion
 Rates Fringes

ELECTRICIAN
 Alarm Installation & Low
 Voltage Wiring.....\$ 31.20 9.25+5.5%

 ELEV0085-002 01/01/2024
 Rates Fringes
 ELEVATOR MECHANIC.....\$ 62.78 37.885+a+b

FOOTNOTES:
 a. PAID HOLIDAYS: New Years Day; Memorial Day; Independence
 Day; Labor Day; Veterans' Day; Thanksgiving Day; the Friday
 after Thanksgiving Day; and Christmas Day.
 b. Employer contributes 8% basic hourly rate for 5 years or

more of service of 6% basic hourly rate for 6 months to 5 years of service as vacation pay credit.

 ENGI0324-011 06/01/2023

	Rates	Fringes
OPERATOR: Power Equipment		
GROUP 1.....	\$ 47.28	25.25
GROUP 2.....	\$ 43.93	25.25
GROUP 3.....	\$ 41.28	25.25
GROUP 4.....	\$ 39.57	25.25
GROUP 5.....	\$ 39.57	25.25
GROUP 6.....	\$ 33.71	25.25
GROUP 7.....	\$ 31.23	25.25

FOOTNOTES:

Crane operator with main boom and jib 300' or longer: \$1.50 per hour above the group 1 rate. Crane operator with main boom and jib 400' or longer: \$3.00 per hour above the group 1 rate.

PAID HOLIDAYS: New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Crane operator with main boom and jib 400', 300', or 220' or longer.

GROUP 2: Crane operator with main boom and jib 140' or longer, tower crane, gantry crane, whirley derrick

GROUP 3: Backhoe/Excavator/Trackhoe; Bulldozer; Concrete Pump; Crane; Grader/Blade; Highlift; Hoist; Loader; Roller; Scraper; Stiff Leg Derrick; Tractor; Trencher

GROUP 4: Bobcat/Skid Loader; Broom/Sweeper; Fork Truck (over 20' lift)

GROUP 5: Boom Truck (non-swinging)

GROUP 6: Fork Truck (20' lift and under for masonry work)

GROUP 7: Oiler

 IRON0025-019 06/01/2024

	Rates	Fringes
IRONWORKER		
REINFORCING.....	\$ 33.43	37.15
STRUCTURAL.....	\$ 35.55	35.83

 IRON0025-023 04/01/2022

	Rates	Fringes
IRONWORKER STRUCTURAL (Metal Building Erection Only)		
East of Burkhardt Road.....	\$ 25.81	26.43
West of Burkhardt Road.....	\$ 24.59	25.43

 LABO0259-002 08/01/2023

	Rates	Fringes
LABORER: Asbestos Abatement (Removal from Floors, Walls & Ceilings).....	\$ 34.53	15.47

 LABO0334-005 06/01/2024

	Rates	Fringes
LABORER: Landscape & Irrigation		
GROUP 1.....	\$ 28.60	11.60
GROUP 2.....	\$ 26.34	11.60

CLASSIFICATIONS

GROUP 1: Landscape specialist, including air, gas and diesel equipment operator, lawn sprinkler installer, skidsteer (or equivalent)

GROUP 2: Landscape laborer: small power tool operator, material mover, truck driver and lawn sprinkler installer tender

LABO0499-001 08/01/2022

East of Oak Grove Road and south of M-59, not including the City of Howell

	Rates	Fringes
LABORER		
Common or General; Grade Checker; Sandblaster.....	\$ 30.66	14.70
Grade Checker; Sandblaster..	\$ 29.37	13.38
Mason Tender - Brick; Mason Tender -		
Cement/Concrete.....	\$ 31.21	14.70
Pipelaye.....	\$ 31.02	14.70

LABO0499-010 06/01/2024

West of Oak Grove Road to west of Pinkney Road and Dexter Pinkney Road, including the City of Howell

	Rates	Fringes
LABORER		
Grade Checker; Mason Tender - Brick; Mason Tender - Cement/Concrete;		
Pipelaye; Sandblaster.....	\$ 33.58	13.45

LABO1076-001 06/01/2024

East of Oak Grove Rd. & North of M-59 (does not include the city of Howell)

	Rates	Fringes
LABORER		
Grade Checker; Mason Tender - Brick/Cement/Concrete;		
Pipelaye; Sandblaster.....	\$ 35.34	17.75

PAIN0022-001 06/01/2022

East of the city limits of Howell directly north to the Genessee County line and south to the Washtenaw County line:

	Rates	Fringes
PAINTER: Brush and Roller.....	\$ 32.85	20.41
PAINTER: Drywall		
Finishing/Taping.....	\$ 32.85	20.41
PAINTER: Spray.....	\$ 26.86	17.66

 PAIN0357-001 06/01/2023
 Eastern Half Including the City of Howell

	Rates	Fringes
GLAZIER.....	\$ 38.66	20.98

PAID HOLIDAYS: New Year's Day, Decoration Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day; provided that the employee has worked the last full regular scheduled work day prior to the holiday, and the first full regular scheduled work day following the holiday, provided the employee is physically able to work.

* PAIN0826-003 06/01/2024
 Western Half Including the City of Howell

	Rates	Fringes
GLAZIER.....	\$ 36.80	18.07

PAIN0845-004 06/01/2024
 West of the eastern city limits of Howell, including the city of Howell, north to the Genesee County line and south to the Washtenaw County line

	Rates	Fringes
PAINTER: Brush, Roller and Spray.....	\$ 29.68	20.40
PAINTER: Drywall Finishing/Taping.....	\$ 29.23	19.40

PLAS0016-002 04/01/2014
 Townships of Cohoctah, Conway, Handy & Howell

	Rates	Fringes
PLASTERER.....	\$ 25.39	12.53

PLAS0016-004 04/01/2014
 Townships of Deerfield, Hartland, Oceaola & Tyrone

	Rates	Fringes
PLASTERER.....	\$ 23.73	12.88

PLAS0016-010 04/01/2014

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER Townships of Cohoctah, Conway, Handy, Howell and the entire city of Howell...\$	24.64	12.88
Townships of Deerfield, Hartland, Osceola and Tyrone:.....\$	25.58	12.88

PLAS0067-003 04/01/2014
 Excluding Townships of Cohoctah, Conway, Deerfield, Handy, Hartland, Howell, Osceola & Tyrone

	Rates	Fringes
PLASTERER.....	\$ 30.63	14.07

PLAS0514-008 06/01/2023

Remainder of County		
	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 32.23	22.11

PLUM0098-003 06/01/2023		
Township of Brighton		
	Rates	Fringes
PLUMBER (Including HVAC Pipe Installation; Excluding HVAC System Installation).....	\$ 35.79	28.28

PLUM0190-001 06/01/2024		
Townships of Green Oak & Hamburg		
	Rates	Fringes
PIPEFITTER (Excluding HVAC Pipe Installation; Including HVAC System Installation).....	\$ 49.43	24.36
PLUMBER (Including HVAC Pipe Installation; Excluding HVAC System Installation).....	\$ 49.43	24.36

PLUM0333-001 06/01/2024		
Remainder of County		
	Rates	Fringes
PIPEFITTER (Excluding HVAC Pipe Installation; Including HVAC System Installation).....	\$ 44.79	25.43
PLUMBER (Including HVAC Pipe Installation; Excluding HVAC System Installation).....	\$ 44.79	25.43

FOOTNOTE:
 Paid Holidays: Memorial Day, Independence Day and Labor Day, if the employee works the work day preceding and following the holiday unless proven illness or injury prevents the employee from working.

PLUM0636-004 06/05/2023		
Township of Brighton		
	Rates	Fringes
PIPEFITTER (Excluding HVAC Pipe Installation; Including HVAC System Installation).....	\$ 44.70	25.37

ROOF0070-001 05/08/2024		
	Rates	Fringes
ROOFER.....	\$ 41.17	20.37

SFMI0669-001 01/01/2024		
	Rates	Fringes
SPRINKLER FITTER (Fire Sprinklers).....	\$ 41.34	26.80

SHEE0007-004 05/01/2023		
	Rates	Fringes

SHEET METAL WORKER (Including
HVAC Duct Installation;
Excluding HVAC System
Installation).....\$ 38.09 19.66

SHEE0007-007 05/01/2023

	Rates	Fringes
SHEET METAL WORKER (Including HVAC Duct Installation; Excluding HVAC System Installation).....\$ 38.09	38.09	19.66

* SUMI2011-015 02/01/2011

	Rates	Fringes
ELECTRICIAN, Excludes Low Voltage Wiring for and Installation of Alarms.....\$ 28.14	28.14	8.89
INSTALLER - OVERHEAD DOOR.....\$ 27.98	27.98	0.00
IRONWORKER, ORNAMENTAL.....\$ 18.48	18.48	7.93
LABORER: Common or General.....\$ 17.64	17.64	4.95
TRUCK DRIVER: Tractor Haul Truck.....\$ 13.57 **	13.57	1.18

WELDERS - Receive rate prescribed for craft performing
operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 (\$17.20) or 13658 (\$12.90). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO

is available at

<https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier. Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010

08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier. A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

State Adopted Rate Identifiers

Classifications listed under the "SA" identifier indicate that the prevailing wage rate set by a state (or local) government was adopted under 29 C.F.R. §1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 01/03/2024 reflects the date on which the classifications and rates under the "SA" identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage

payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.
3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"

"General Decision Number: MI20240001 08/02/2024
 Superseded General Decision Number: MI20230001
 State: Michigan
 Construction Types: Highway (Highway, Airport & Bridge xxxxx
 and Sewer/Incid. to Hwy.)
 Counties: Michigan Statewide.
 Note: Contracts subject to the Davis-Bacon Act are generally
 required to pay at least the applicable minimum wage rate
 required under Executive Order 14026 or Executive Order 13658.
 Please note that these Executive Orders apply to covered
 contracts entered into by the federal government that are
 subject to the Davis-Bacon Act itself, but do not apply to
 contracts subject only to the Davis-Bacon Related Acts,
 including those set forth at 29 CFR 5.1(a)(1).

<p>If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:</p>	<ul style="list-style-type: none"> . Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least \$17.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2024.
<p>If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:</p>	<ul style="list-style-type: none"> . Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least \$12.90 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2024.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

Modification Number	Publication Date
0	01/05/2024
1	02/23/2024
2	04/05/2024
3	04/19/2024

4 04/26/2024
 5 05/03/2024
 6 05/17/2024
 7 05/24/2024
 8 06/07/2024
 9 06/14/2024
 10 06/28/2024
 11 07/12/2024
 12 07/26/2024
 13 08/02/2024

CARP0004-004 06/01/2019
 REMAINDER OF STATE

	Rates	Fringes
CARPENTER (Piledriver).....	\$ 27.62	20.59

 CARP0004-005 06/01/2018
 LIVINGSTON (Townships of Brighton, Deerfield, Genoa, Hartland,
 Oceola & Tyrone), MACOMB, MONROE, OAKLAND, SANILAC, ST. CLAIR
 AND WAYNE COUNTIES

	Rates	Fringes
CARPENTER (Piledriver).....	\$ 30.50	27.28

 ELEC0017-005 06/01/2024
 STATEWIDE

	Rates	Fringes
Line Construction		
Groundman/Driver.....	\$ 32.00	33%+7.31
Journeyman Signal Tech, Communications Tech, Tower Tech & Fiber Optic Splicers.	\$ 47.35	33%+7.31
Journeyman Specialist.....	\$ 54.45	33%+7.31
Operator A.....	\$ 40.09	33%+7.31
Operator B.....	\$ 37.46	33%+7.31

Classifications
 Journeyman Specialist: Refers to a crew of only one person
 working alone.
 Operator A: Shall be proficient in operating all power
 equipment including: Backhoe,
 Excavator, Directional Bore and Boom/Digger truck.
 Operator B: Shall be proficient in operating any 2 of the
 above mentioned pieces of
 equipment listed under Operator A.

 ENGI0324-003 06/01/2024
 ALCONA, ALPENA, ARENAC, BAY, CHEBOYGAN, CLARE, CLINTON,
 CRAWFORD, GENESEE, GLADWIN, GRATIOT, HURON, INGHAM, IOSCO,
 ISABELLA, JACKSON, LAPEER, LENAWEE, LIVINGSTON, MACOMB,
 MIDLAND, MONROE, MONTMORENCY, OAKLAND, OGEMAW, OSCODA, OTSEGO,
 PRESQUE ISLE, ROSCOMMON, SAGINAW, ST. CLAIR, SANILAC,
 SHIAWASSEE, TUSCOLA, WASHTENAW AND WAYNE COUNTIES:

	Rates	Fringes
OPERATOR: Power Equipment (Steel Erection)		
GROUP 1.....	\$ 55.42	25.25

GROUP 2.....	\$ 56.42	25.25
GROUP 3.....	\$ 53.92	25.25
GROUP 4.....	\$ 54.92	25.25
GROUP 5.....	\$ 52.42	25.25
GROUP 6.....	\$ 53.42	25.25
GROUP 7.....	\$ 52.15	25.25
GROUP 8.....	\$ 53.15	25.25
GROUP 9.....	\$ 51.70	25.25
GROUP 10.....	\$ 52.70	25.25
GROUP 11.....	\$ 50.97	25.25
GROUP 12.....	\$ 51.97	25.25
GROUP 13.....	\$ 50.61	25.25
GROUP 14.....	\$ 51.61	25.25
GROUP 15.....	\$ 49.97	25.25
GROUP 16.....	\$ 46.77	25.25
GROUP 17.....	\$ 32.29	12.40
GROUP 18.....	\$ 35.78	25.25

FOOTNOTE:

Paid Holidays: New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

- GROUP 1: Engineer when operating combination of boom and jib 400' or longer
- GROUP 2: Engineer when operating combination of boom and jib 400' or longer on a crane that requires an oiler
- GROUP 3: Engineer when operating combination of boom and jib 300' or longer
- GROUP 4: Engineer when operating combination of boom and jib 300' or longer on a crane that requires an oiler
- GROUP 5: Engineer when operating combination of boom and jib 220' or longer
- GROUP 6: Engineer when operating combination of boom and jib 220' or longer on a crane that requires an oiler
- GROUP 7: Engineer when operating combination of boom and jib 140' or longer
- GROUP 8: Engineer when operating combination of boom and jib 140' or longer on a crane that requires an oiler
- GROUP 9: Tower crane & derrick operator (where operator's work station is 50 ft. or more above first sub-level)
- GROUP 10: Tower crane & derrick operator (where operator's work station is 50 ft. or more above first sub-level) on a crane that requires an oiler
- GROUP 11: Engineer when operating combination of boom and jib 120' or longer
- GROUP 12: Engineer when operating combination of boom and jib 120' or longer on a crane that requires an oiler
- GROUP 13: Crane operator; job mechanic and 3 drum hoist and excavator
- GROUP 14: Crane operator on a crane that requires an oiler
- GROUP 15: Hoisting operator; 2 drum hoist and rubber tired backhoe
- GROUP 16: Forklift and 1 drum hoist
- GROUP 17: Compressor or welder operator
- GROUP 18: Oiler

ENGI0324-004 06/01/2024

AREA 1: ALLEGAN, BARRY, BERRIEN, BRANCH, CALHOUN, CASS, EATON, HILLSDALE, IONIA, KALAMAZOO, KENT, LAKE, MANISTEE, MASON, MECOSTA, MONTCALM, MUSKEGON, NEWAYGO, OCEANA, OSCEOLA, OTTAWA, ST. JOSEPH, VAN BUREN

AREA 2: ANTRIM, BENZIE, CHARLEVOIX, EMMET, GRAND TRAVERSE, KALKASKA, LEELANAU, MISSAUKEE AND WEXFORD COUNTIES:

	Rates	Fringes
OPERATOR: Power Equipment (Steel Erection)		
AREA 1		
GROUP 1.....	\$ 55.02	25.25
GROUP 2.....	\$ 52.15	25.25
GROUP 3.....	\$ 50.61	25.25
GROUP 4.....	\$ 46.77	25.25
GROUP 5.....	\$ 32.29	12.40
GROUP 6.....	\$ 35.78	25.25
AREA 2		
GROUP 1.....	\$ 55.02	25.25
GROUP 2.....	\$ 52.15	24.25
GROUP 3.....	\$ 50.61	25.25
GROUP 4.....	\$ 46.77	25.25
GROUP 5.....	\$ 32.29	12.40
GROUP 6.....	\$ 35.78	25.25

FOOTNOTES:

Crane operator with main boom and jib 300' or longer: \$1.50 additional to the group 1 rate. Crane operator with main boom and jib 400' or longer: \$3.00 additional to the group 1 rate.

PAID HOLIDAYS: New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS:

GROUP 1: Crane Operator with main boom & jib 400', 300', or 220' or longer.

GROUP 2: Crane Operator with main boom & jib 140' or longer, Tower Crane; Gantry Crane; Whirley Derrick.

GROUP 3: Regular Equipment Operator, Crane, Dozer, Loader, Hoist, Straddle Wagon, Mechanic, Grader and Hydro Excavator.

GROUP 4: Air Tugger (single drum), Material Hoist Pump 6" or over, Elevators, Brokk Concrete Breaker.

GROUP 5: Air Compressor, Welder, Generators, Conveyors

GROUP 6: Oiler and fire tender

ENGI0324-005 09/01/2023

AREA 1: GENESEE, LAPEER, LIVINGSTON, MACOMB, MONROE, OAKLAND, ST. CLAIR, WASHTENAW AND WAYNE COUNTIES

AREA 2: ALCONA, ALLEGAN, ALGER, ALPENA, ANTRIM, ARENAC, BARAGA, BARRY, BAY, BENZIE, BERRIEN, BRANCH, CALHOUN, CASS, CHARLEVOIX, CHEBOYGAN, CHIPPEWA, CLARE, CLINTON, CRAWFORD, DELTA, DICKINSON, EATON, EMMET, GLADWIN, GOGEBIC, GRAND TRAVERSE, GRATIOT, HILLSDALE, HOUGHTON, HURON, INGHAM, IONIA, IOSCO, IRON, ISABELLA, JACKSON, KALAMAZOO, KALKASKA, KENT, KWEENAW, LAKE, LEELANAU, LENAWE, LUCE, MACKINAC, MANISTEE,

MARQUETTE, MASON, MECOSTA, MENOMINEE, MIDLAND, MISSAUKEE,
 MONTCALM, MONTMORENCY, MUSKEGON, NEWAYGO, OCEANA, OGEMAW,
 ONTONAGON, OSCEOLA, OSCODA, OTSEGO, OTTAWA, PRESQUE ISLE,
 ROSCOMMON, SAGINAW, SANILAC, SCHOOLCRAFT, SHIAWASSEE, ST.
 JOSEPH, TUSCOLA, VAN BUREN AND WEXFORD COUNTIES

Rates Fringes

OPERATOR: Power Equipment
 (Underground construction
 (including sewer))

AREA 1:

GROUP 1.....	\$ 41.08	25.25
GROUP 2.....	\$ 36.25	25.25
GROUP 3.....	\$ 35.52	25.25
GROUP 4.....	\$ 34.95	25.25
GROUP 5.....	\$ 25.35	12.10

AREA 2:

GROUP 1.....	\$ 39.27	25.25
GROUP 2.....	\$ 34.38	25.25
GROUP 3.....	\$ 33.88	25.25
GROUP 4.....	\$ 33.60	25.25
GROUP 5.....	\$ 25.35	12.10

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Backfiller tamper; Backhoe; Batch plant operator
 (concrete); Clamshell; Concrete paver (2 drums or larger);
 Conveyor loader (Euclid type); Crane (crawler, truck type
 or pile driving); Dozer; Dragline; Elevating grader;
 Endloader; Gradall (and similar type machine); Grader;
 Mechanic; Power shovel; Roller (asphalt); Scraper
 (self-propelled or tractor drawn); Side boom tractor (type
 D-4 or equivalent and larger); Slip form paver; Slope
 paver; Trencher (over 8 ft. digging capacity); Well
 drilling rig; Concrete pump with boom operator; Hydro
 Excavator

GROUP 2: Boom truck (power swing type boom); Crusher; Hoist;
 Pump (1 or more - 6-in. discharge or larger - gas or
 diesel- powered or powered by generator of 300 amperes or
 more - inclusive of generator); Side boom tractor (smaller
 than type D-4 or equivalent); Tractor (pneu-tired, other
 than backhoe or front end loader); Trencher (8-ft. digging
 capacity and smaller); Vac Truck and End dump operator;

GROUP 3: Air compressors (600 cfm or larger); Air compressors
 (2 or more-less than 600 cfm); Boom truck (non-swinging,
 non- powered type boom); Concrete breaker (self-propelled
 or truck mounted - includes compressor); Concrete paver (1
 drum-1/2 yd. or larger); Elevator (other than passenger);
 Maintenance person; Pump (2 or more-4-in. up to 6-in.
 discharge-gas or diesel powered - excluding submersible
 pumps); Pumpcrete machine (and similar equipment); Wagon
 drill (multiple); Welding machine or generator (2 or
 more-300 amp. or larger - gas or diesel powered)

GROUP 4: Boiler; Concrete saw (40 hp or over); Curing machine
 (self-propelled); Farm tractor (with attachment); Finishing
 machine (concrete); Hydraulic pipe pushing machine;
 Mulching equipment; Pumps (2 or more up to 4-in. discharge,

if used 3 hours or more a day, gas or diesel powered -
 excluding submersible pumps); Roller (other than asphalt);
 Stump remover; Trencher (service); Vibrating compaction
 equipment, self-propelled (6 ft. wide or over); Sweeper
 (Wayne type); Water wagon and Extend-a boom forklift
 Group 5: Fire Person, Oiler

 * ENGI0324-006 06/01/2024

GENESEE, MACOMB, MONROE, OAKLAND, WASHTENAW, WAYNE, ALCONA,
 ALGER, ALLEGAN, ALPENA, ANTRIM, ARENAC, BARAGA, BARRY, BAY,
 BENZIE, BERRIEN, BRANCH, CALHOUN, CASS, CHARLEVOIX, CHEBOYGAN,
 CHIPPEWA, CLARE, CLINTON, CRAWFORD, DELTA, DICKINSON, EATON,
 EMMET, GLADWIN, GOGEBIC, GRAND TRAVERSE, GRATIOT, HILLSDALE,
 HOUGHTON, HURON, INGHAM, IONIA, IOSCO, IRON, ISABELLA, JACKSON,
 KALAMAZOO, KALKASKA, KENT, KEWEENAW, LAKE, LAPEER, LEELANAU,
 LENAWEE, LIVINGSTON, LUCE, MACKINAC, MANISTEE, MARQUETTE,
 MASON, MECOSTA, MENOMINEE, MIDLAND, MISSAUKEE, MONTCALM,
 MONTMORENCY, MUSKEGON, NEWAYGO, OCEANA, OGEMAW, ONTONAGON,
 OSCEOLA, OSCODA, OTSEGO, OTTAWA, PRESQUE ISLE, ROSCOMMON,
 SAGINAW, ST. CLARE, ST. JOSEPH, SANILAC, SCHOOLCRAFT,
 SHIAWASSEE, TUSCOLA, VAN BUREN AND WEXFORD COUNTIES

Rates Fringes

Power equipment operators:
 (AIRPORT, BRIDGE & HIGHWAY
 CONSTRUCTION)

GROUP 1.....	\$ 43.71	25.25
GROUP 2.....	\$ 42.56	25.25
GROUP 3.....	\$ 35.83	25.55
GROUP 4.....	\$ 35.27	25.25

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Paver Operator (5 bags or more); Slip Form Paver;
 Asphalt Paver (self propelled); Shovel (Excavator)
 installing utilities over 20 feet in depth.
 Group 2: Asphalt plant operator; crane operator (does not
 include work on bridge construction projects when the crane
 operator is erecting structural components); Dragline
 operator; Shovel (Excavator) operator; Locomotive operator;
 Elevating grader operator; Pile driving operator; Roller
 operator (asphalt); Blade grader operator; Trenching
 machine operator (ladder or wheel type); Auto-grader;
 Self-propelled or tractor-drawn scraper; Conveyor loader
 operator (Euclid type); Bulldozer; Hoisting engineer;
 Tractor operator; Finishing machine operator (asphalt);
 Mechanic; Pump operator (6-in. discharge or over, gas,
 diesel powered or generator of 300 amp. or larger);
 Shouldering or gravel distributing machine operator (self-
 propelled); Backhoe (with over 3/8 yd. bucket); Side boom
 tractor (type D-4 or equivalent or larger); Tube finisher
 (slip form paving); Gradall (and similar type machine);
 Asphalt planner (self- propelled); Batch plant
 (concrete-central mix); Slurry machine (asphalt); Concrete
 pump (3 in. and over); Roto-mill; Swinging boom truck (over
 12 ton capacity); Hydro demolisher (water blaster);
 Farm-type tractor with attached pan; Vacuum truck operator;

Batch Plant (concrete dry batch); Concrete Saw Operator (40h.p. or over; Tractor Operator (farm type); Finishing Machine Operator (concrete); Grader Operator (self-propelled fine grade or form (concrete); tractor operator (farm type with attachment); Wagon Drill operator; Boom or winch hoist truck operator.

GROUP 3: Screening plant operator; Washing plant operator; Crusher operator; Backhoe (with 3/8 yd. bucket or less); Side boom tractor (smaller than D-4 type or equivalent); Sweeper (Wayne type and similar equipment); Greese Truck; Air Compressor Operator (600 cu.ft. per min or more); Air Compressor Operator (two or more, less than 600 cfm); End Loader operator (1 yard Capacity and over); Side boom tractor (type D or equivalent or larger; Endloader operator *under 1 yard capacity; Trencher (service).

GROUP 4: Boiler fire tender; Concrete Breaker; Oiler; Fire tender; Trencher (service); Flexplane operator; Cleftplane operator; Roller operator (other than asphalt); Curing equipment operator (self-propelled); Power bin operator; Plant drier operator (asphalt); Vibratory compaction equipment operator (6 ft. wide or over); Guard post driver operator (power driven); All mulching equipment; Stump remover; Concrete pump (under 3-in.); Mesh installer (self-propelled); End dump; Skid steer.

 ENGI0324-007 05/01/2024

ALGER, BARAGA, CHIPPEWA, DELTA, DICKINSON, GOGEBIC, HOUGHTON, IRON, KEWEENAW, LUCE, MACKINAC MARQUETTE, MENOMINEE, ONTONAGON AND SCHOOLCRAFT COUNTIES:

	Rates	Fringes
OPERATOR: Power Equipment (Steel Erection)		
Compressor, welder and forklift.....	\$ 40.90	25.00
Crane operator, main boom & jib 120' or longer.....	\$ 47.37	25.00
Crane operator, main boom & jib 140' or longer.....	\$ 47.37	24.60
Crane operator, main boom & jib 220' or longer.....	\$ 48.26	25.00
Mechanic with truck and tools.....	\$ 46.50	25.00
Oiler and fireman.....	\$ 39.96	25.00
Regular operator.....	\$ 44.72	25.00

 ENGI0324-008 10/01/2023

ALCONA, ALGER, ALLEGAN, ALPENA, ANTRIM, ARENAC, BARAGA, BARRY, BAY, BENZIE, BERRIEN, BRANCH, CALHOUN, CASS, CHARLEVOIX, CHEBOYGAN, CHIPPEWA, CLARE, CLINTON, CRAWFORD, DELTA, DICKINSON, EATON, EMMET, GENESEE, GLADWIN, GOGEBIC, GRAND TRAVERSE, GRATIOT, HILLSDALE, HOUGHTON, HURON, INGHAM, IONIA, IOSCO, IRON, ISABELLA, JACKSON, KALAMAZOO, KALKASKA, KENT, KEWEENAW, LAKE, LAPEER, LEELANAU, LENAWEE, LIVINGSTON, LUCE, MACKINAC, MACOMB, MANISTEE, MARQUETTE, MASON, MECOSTA,

MENOMINEE, MIDLAND, MISSAUKEE, MONTCALM, MONTMORENCY, MONROE,
 MUSKOGON, NEWAYGO, OAKLAND, OCEANA, OGEMAW, ONTONAGON, OSCEOLA,
 OSCODA, OTSEGO, OTTAWA, PRESQUE ISLE, ROSCOMMON, SAGINAW, ST.
 CLARE, ST. JOSEPH, SANILAC, SCHOOLCRAFT, SHIAWASSEE, TUSCOLA,
 VAN BUREN, WASHTENAW, WAYNE AND WEXFORD COUNTIES

Rates Fringes

OPERATOR: Power Equipment
 (Sewer Relining)

GROUP 1.....	\$ 37.37	15.44
GROUP 2.....	\$ 35.33	15.44

SEWER RELINING CLASSIFICATIONS

GROUP 1: Operation of audio-visual closed circuit TV system,
 including remote in-ground cutter and other equipment used
 in connection with the CCTV system

GROUP 2: Operation of hot water heaters and circulation
 systems, water jettors and vacuum and mechanical debris
 removal systems

 ENGI0325-012 05/01/2024

Rates Fringes

Power equipment operators -
 gas distribution and duct
 installation work:

GROUP 1.....	\$ 37.98	25.25
GROUP 2.....	\$ 34.75	25.25

SCOPE OF WORK: The construction, installation, treating and
 reconditioning of pipelines transporting gas vapors within
 cities, towns, subdivisions, suburban areas, or within
 private property boundaries, up to and including private
 meter settings of private industrial, governmental or other
 premises, more commonly referred to as "distribution work,"
 starting from the first metering station, connection,
 similar or related facility, of the main or cross country
 pipeline and including duct installation.

Group 1: Backhoe, crane, grader, mechanic, dozer (D-6
 equivalent or larger), side boom (D-4 equivalent or
 larger), trencher(except service), endloader (2 yd.
 capacity or greater).

GROUP 2: Dozer (less than D-6 equivalent), endloader (under
 2 yd. capacity), side boom (under D-4 capacity),
 backfiller, pumps (1 or 2 of 6-inch discharge or greater),
 boom truck (with powered boom), tractor (wheel type other
 than backhoe or front endloader). Tamper (self-propelled),
 boom truck (with non-powered boom), concrete saw (20 hp or
 larger), pumps (2 to 4 under 6-inch discharge), compressor
 (2 or more or when one is used continuously into the second
 day) and trencher(service). Oiler, hydraulic pipe pushing
 machine, grease person and hydrostatic testing operator.

 IRON0008-007 06/01/2022

ALGER, BARAGA, CHIPPEWA, DELTA, DICKINSON, GOGEBIC, HOUGHTON,
 IRON, KEWEENAW, LUCE, MACKINAC MARQUETTE, MENOMINEE, ONTONAGON
 AND SCHOOLCRAFT COUNTIES:

Rates Fringes

Ironworker - pre-engineered metal building erector.....	\$ 23.70	6.95
IRONWORKER		
General contracts \$10,000,000 or greater.....	\$ 38.14	28.70
General contracts less than \$10,000,000.....	\$ 38.14	28.70
Paid Holidays: New Year's Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day & Christmas Day.		

IRON0025-002 06/01/2024
ALCONA, ALPENA, ARENAC, BAY, CHEBOYGAN, CLARE, CLINTON,
CRAWFORD, GENESEE, GLADWIN, GRATIOT, HURON, INGHAM, IOSCO,
ISABELLA, JACKSON, LAPEER, LIVINGSTON, MACOMB, MIDLAND,
MONTMORENCY, OAKLAND, OGEAW, OSCODA, OTSEGO, PRESQUE ISLE,
ROSCOMMON, SAGINAW, SANILAC, SHIAWASSEE, ST. CLAIR, TUSCOLA,
WASHTENAW AND WAYNE COUNTIES:

	Rates	Fringes
Ironworker - pre-engineered metal building erector		
ALLEGAN, ANTRIM, BARRY, BENZIE, BRANCH, CALHOUN, CHARLEVOIX, EATON, EMMET, GRAND TRAVERSE, HILLSDALE, IONIA, KALAMAZOO, KALKASKA, KENT, LAKE, LEELANAU, MANISTEE, MASON, MECOSTA, MISSAUKEE, MONTCALM, MUSKEGON, NEWAYGO, OCEANA, OSCEOLA, OTTAWA, ST. JOSEPH, VAN BUREN AND WEXFORD COUNTIES:..	\$ 35.55	33.14
Bay, Genesee, Lapeer, Livingston (east of Burkhardt Road), Macomb, Midland, Oakland, Saginaw, St. Clair, The University of Michigan, Washtenaw (east of U.S. 23) & Wayne...	\$ 25.81	26.43
IRONWORKER		
Ornamental and Structural...	\$ 34.50	38.44
Reinforcing.....	\$ 33.43	37.15

IRON0055-005 07/01/2022
LENAWEE AND MONROE COUNTIES:

	Rates	Fringes
IRONWORKER		
Pre-engineered metal buildings.....	\$ 23.59	19.35
All other work.....	\$ 33.00	27.20

IRON0292-003 06/01/2020
BERRIEN AND CASS COUNTIES:

	Rates	Fringes
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IRONWORKER (Including
pre-engineered metal building
erector).....\$ 31.75 22.84

* LABO0005-006 10/01/2022

	Rates	Fringes
Laborers - hazardous waste abatement: (ALCONA, ALPENA, ANTRIM, BENZIE, CHARLEVOIX, CHEBOYGAN, CRAWFORD, EMMET, GRAND TRAVERSE, IOSCO, KALKASKA, LEELANAU, MISSAUKEE, MONTMORENCY, OSCODA, OTSEGO, PRESQUE ISLE AND WEXFORD COUNTIES - Zone 10)		
Levels A, B or C.....	\$ 17.45	12.75
class b.....	\$ 18.64	12.90
Work performed in conjunction with site preparation not requiring the use of personal protective equipment;		
Also, Level D.....	\$ 16.45 **	12.75
class a.....	\$ 17.64	12.90
Zone 10		
Laborers - hazardous waste abatement: (ALGER, BARAGA, CHIPPEWA, DELTA, DICKINSON, GOGEBIC, HOUGHTON, IRON, KEWEENAW, LUCE, MACKINAC, MARQUETTE, MENOMINEE, ONTONAGON AND SCHOOLCRAFT COUNTIES - Zone 11)		
Levels A, B or C.....	\$ 25.18	12.90
Work performed in conjunction with site preparation not requiring the use of personal protective equipment;		
Also, Level D.....	\$ 22.58	12.90
Laborers - hazardous waste abatement: (ALLEGAN, BARRY, BERRIEN, BRANCH, CALHOUN, CASS, IONIA COUNTY (except the city of Portland); KALAMAZOO, KENT, LAKE, MANISTEE, MASON, MECOSTA, MONTCALM, MUSKEGON, NEWAYGO, OCEANA, OSCEOLA, OTTAWA, ST. JOSEPH AND VAN BUREN COUNTIES - Zone 9)		
Levels A, B or C.....	\$ 21.88	13.26
Work performed in		

conjunction with site preparation not requiring the use of personal protective equipment; Also, Level D.....\$ 20.80	12.90
Laborers - hazardous waste abatement: (ARENAC, BAY, CLARE, GLADWIN, GRATIOT, HURON, ISABELLA, MIDLAND, OGEMAW, ROSCOMMON, SAGINAW AND TUSCOLA COUNTIES - Zone 8)	
Levels A, B or C.....\$ 23.74	12.95
Work performed in conjunction with site preparation not requiring the use of personal protective equipment; Also, Level D.....\$ 20.80	12.90
Laborers - hazardous waste abatement: (CLINTON, EATON AND INGHAM COUNTIES; IONIA COUNTY (City of Portland); LIVINGSTON COUNTY (west of Oak Grove Rd., including the City of Howell) - Zone 6)	
Levels A, B or C.....\$ 26.33	12.95
Work performed in conjunction with site preparation not requiring the use of personal protective equipment; Also, Level D.....\$ 24.64	12.90
Laborers - hazardous waste abatement: (GENESEE, LAPEER AND SHIAWASSEE COUNTIES - Zone 7)	
Levels A, B or C.....\$ 24.20	13.80
Work performed in conjunction with site preparation not requiring the use of personal protective equipment; Also, Level D.....\$ 23.20	13.80
Laborers - hazardous waste abatement: (HILLSDALE, JACKSON AND LENAWEЕ COUNTIES - Zone 4)	
Levels A, B or C.....\$ 27.13	14.95
Work performed in conjunction with site preparation not requiring the use of personal protective equipment; Also, Level D.....\$ 24.17	12.90

Laborers - hazardous waste abatement: (LIVINGSTON COUNTY (east of Oak Grove Rd. and south of M-59, excluding the city of Howell); AND WASHTENAW COUNTY - Zone 3)		
Levels A, B or C.....\$ 29.93		14.20
Work performed in conjunction with site preparation not requiring the use of personal protective equipment;		
Also, Level D.....\$ 28.93		14.20
Laborers - hazardous waste abatement: (MACOMB AND WAYNE COUNTIES - Zone 1)		
Levels A, B or C.....\$ 29.93		16.90
Work performed in conjunction with site preparation not requiring the use of personal protective equipment;		
Also, Level D.....\$ 28.93		16.90
Laborers - hazardous waste abatement: (MONROE COUNTY - Zone 4)		
Levels A, B or C.....\$ 31.75		14.90
Work performed in conjunction with site preparation not requiring the use of personal protective equipment;		
Also, Level D.....\$ 31.75		14.90
Laborers - hazardous waste abatement: (OAKLAND COUNTY and the Northeast portion of LIVINGSTON COUNTY bordered by Oak Grove Road on the West and M-59 on the South - Zone 2)		
Level A, B, C.....\$ 29.93		16.90
Work performed in conjunction with site preparation not requiring the use of personal protective equipment;		
Also, Level D.....\$ 28.93		16.90
Laborers - hazardous waste abatement: (SANILAC AND ST. CLAIR COUNTIES - Zone 5)		
Levels A, B or C.....\$ 26.21		16.62
Work performed in conjunction with site preparation not requiring		

the use of personal
protective equipment;

Also, Level D.....\$ 24.75 16.35

LABO0259-001 09/01/2023

AREA 1: MACOMB, OAKLAND AND WAYNE COUNTIES

AREA 2: ALCONA, ALGER, ALLEGAN, ALPENA, ANTRIM, ARENAC, BARAGA,
BARRY, BAY, BENZIE, BERRIEN, BRANCH, CALHOUN, CASS, CHARLEVOIX,
CHEBOYGAN, CHIPPEWA, CLARE, CLINTON, CRAWFORD, DELTA,
DICKINSON, EATON, EMMET, GENESEE, GLADWIN, GOGEBIC, GRAND
TRAVERSE, GRATIOT, HILLSDALE, HOUGHTON, HURON, INGHAM, IONIA,
IOSCO, IRON, ISABELLA, JACKSON, KALAMAZOO, KALKASKA, KENT,
KEWEENAW, LAKE, LAPEER, LEELANAU, LENAWEE, LIVINGSTON, LUCE,
MACKINAC, MANISTEE, MARQUETTE, MASON, MECOSTA, MENOMINEE,
MIDLAND, MISSAUKEE, MONROE, MONTCALM, MONTMORENCY, MUSKEGON,
NEWAYGO, OCEANA, OGEMAW, ONTONAGON, OSCEOLA, OSCODA, OTSEGO,
OTTAWA, PRESQUE ISLE, ROSCOMMON, SAGINAW, ST. CLARE, ST.
JOSEPH, SANILAC, SCHOOLCRAFT, SHIAWASSEE, TUSCOLA, VAN BUREN,
WASHTENAW AND WEXFORD COUNTIES

	Rates	Fringes
Laborers - tunnel, shaft and caisson:		

AREA 1

GROUP 1.....	\$ 23.62	16.93
GROUP 2.....	\$ 23.73	16.93
GROUP 3.....	\$ 23.79	16.93
GROUP 4.....	\$ 23.97	16.93
GROUP 5.....	\$ 24.22	16.93
GROUP 6.....	\$ 24.55	16.93
GROUP 7.....	\$ 17.83	16.93

AREA 2

GROUP 1.....	\$ 27.57	16.93
GROUP 2.....	\$ 25.24	16.93
GROUP 3.....	\$ 25.34	16.93
GROUP 4.....	\$ 29.57	16.93
GROUP 5.....	\$ 25.76	16.93
GROUP 6.....	\$ 26.07	16.93
GROUP 7.....	\$ 25.57	16.93

SCOPE OF WORK: Tunnel, shaft and caisson work of every type
and description and all operations incidental thereto,
including, but not limited to, shafts and tunnels for
sewers, water, subways, transportation, diversion,
sewerage, caverns, shelters, aquifers, reservoirs, missile
silos and steel sheeting for underground construction.

TUNNEL LABORER CLASSIFICATIONS

GROUP 1: Tunnel, shaft and caisson laborer, dump, shanty, hog
house tender, testing (on gas) and watchman
GROUP 2: Manhole, headwall, catch basin builder, bricklayer
tender, mortar machine and material mixer
GROUP 3: Air tool operator (jackhammer, bush hammer and
grinder), first bottom, second bottom, cage tender, car
pusher, carrier, concrete, concrete form, concrete repair,
cement invert laborer, cement finisher, concrete shoveler,
conveyor, floor, gasoline and electric tool operator,

gunite, grout operator, welder, heading dinky person, inside lock tender, pea gravel operator, pump, outside lock tender, scaffold, top signal person, switch person, track, tugger, utility person, vibrator, winch operator, pipe jacking, wagon drill and air track operator and concrete saw operator (under 40 h.p.)

GROUP 4: Tunnel, shaft and caisson mucker, bracer, liner plate, long haul dinky driver and well point

GROUP 5: Tunnel, shaft and caisson miner, drill runner, key board operator, power knife operator, reinforced steel or mesh (e.g. wire mesh, steel mats, dowel bars, etc.)

GROUP 6: Dynamite and powder

GROUP 7: Restoration laborer, seeding, sodding, planting, cutting, mulching and top soil grading; and the restoration of property such as replacing mailboxes, wood chips, planter boxes, flagstones, etc.

LABO0334-001 09/01/2023

	Rates	Fringes
Laborers - open cut:		
ZONE 1 - MACOMB, OAKLAND AND WAYNE COUNTIES:		
GROUP 1.....	\$ 29.87	16.95
GROUP 2.....	\$ 31.87	16.95
GROUP 3.....	\$ 28.03	16.95
GROUP 4.....	\$ 23.71	16.72
GROUP 5.....	\$ 24.17	16.72
GROUP 6.....	\$ 22.00	16.72
GROUP 7.....	\$ 17.84	16.72
ZONE 2 - LIVINGSTON COUNTY (east of M-151 (Oak Grove Rd.)); MONROE AND WASHTENAW COUNTIES:		
GROUP 1.....	\$ 30.70	13.45
GROUP 2.....	\$ 32.70	13.45
GROUP 3.....	\$ 26.89	13.45
GROUP 4.....	\$ 25.10	16.72
GROUP 5.....	\$ 25.25	16.72
GROUP 6.....	\$ 22.55	16.72
GROUP 7.....	\$ 22.11	16.72
ZONE 3 - CLINTON, EATON, GENESEE, HILLSDALE AND INGHAM COUNTIES; IONIA COUNTY (City of Portland); JACKSON, LAPEER AND LENAWEE COUNTIES; LIVINGSTON COUNTY (west of M-151 Oak Grove Rd.); SANILAC, ST. CLAIR AND SHIAWASSEE COUNTIES:		
GROUP 1.....	\$ 28.89	13.45
GROUP 2.....	\$ 30.89	13.45
GROUP 3.....	\$ 26.89	13.45
GROUP 4.....	\$ 23.30	16.72

GROUP 5.....	\$ 23.44	16.72
GROUP 6.....	\$ 20.74	16.72
GROUP 7.....	\$ 22.23	16.72

ZONE 4 - ALCONA, ALLEGAN,
ALPENA, ANTRIM, ARENAC,
BARRY, BAY, BENZIE,
BERRIEN, BRANCH,
CALHOUN, CASS, CHARLEVOIX,
CHEBOYGAN, CLARE,
CRAWFORD, EMMET,
GLADWIN, GRAND TRAVERSE,
GRATIOT AND HURON
COUNTIES; IONIA COUNTY
(EXCEPT THE CITY OF
PORTLAND); IOSCO,
ISABELLA, KALAMAZOO,
KALKASKA, KENT,
LAKE, LEELANAU, MANISTEE,
MASON, MECOSTA, MIDLAND,
MISSAUKEE, MONTCALM,
MONTMORENCY, MUSKEGON,
NEWAYGO, OCEANA, OGEMAW,
OSCEOLA, OSCODA, OTSEGO,
OTTAWA, PRESQUE ISLE,
ROSCOMMON, SAGINAW, ST.
JOSEPH, TUSCOLA, VAN BUREN
AND WEXFORD COUNTIES:

GROUP 1.....	\$ 27.87	13.45
GROUP 2.....	\$ 29.87	13.45
GROUP 3.....	\$ 25.87	13.45
GROUP 4.....	\$ 22.33	16.72
GROUP 5.....	\$ 22.45	16.72
GROUP 6.....	\$ 19.67	16.72
GROUP 7.....	\$ 22.30	16.72

ZONE 5 - ALGER, BARAGA,
CHIPPEWA, DELTA,
DICKINSON, GOGEBIC,
HOUGHTON, IRON,
KEWEENAW, LUCE, MACKINAC,
MARQUETTE, MENOMINEE,
ONTONAGON AND SCHOOLCRAFT
COUNTIES:

GROUP 1.....	\$ 28.09	13.45
GROUP 2.....	\$ 30.09	13.45
GROUP 3.....	\$ 26.09	13.45
GROUP 4.....	\$ 22.56	16.72
GROUP 5.....	\$ 22.64	16.72
GROUP 6.....	\$ 19.99	16.72
GROUP 7.....	\$ 22.45	16.72

SCOPE OF WORK:

Open cut construction work shall be construed to mean work which requires the excavation of earth including industrial, commercial and residential building site excavation and preparation, land balancing, demolition and

removal of concrete and underground appurtenances, grading, paving, sewers, utilities and improvements; retention, oxidation, flocculation and irrigation facilities, and also including but not limited to underground piping, conduits, steel sheeting for underground construction, and all work incidental thereto, and general excavation. For all areas except the Upper Peninsula, open cut construction work shall also be construed to mean waterfront work, piers, docks, seawalls, breakwalls, marinas and all incidental work. Open cut construction work shall not include any structural modifications, alterations, additions and repairs to buildings, or highway work, including roads, streets, bridge construction and parking lots or steel erection work and excavation for the building itself and back filling inside of and within 5 ft. of the building and foundations, footings and piers for the building. Open cut construction work shall not include any work covered under Tunnel, Shaft and Caisson work.

OPEN CUT LABORER CLASSIFICATIONS

GROUP 1: Construction laborer

GROUP 2: Mortar and material mixer, concrete form person, signal person, well point person, manhole, headwall and catch basin builder, headwall, seawall, breakwall and dock builder

GROUP 3: Air, gasoline and electric tool operator, vibrator operator, driller, pump person, tar kettle operator, bracer, rodder, reinforced steel or mesh person (e.g., wire mesh, steel mats, dowel bars, etc.), welder, pipe jacking and boring person, wagon drill and air track operator and concrete saw operator (under 40 h.p.), windlass and tugger person and directional boring person

GROUP 4: Trench or excavating grade person

GROUP 5: Pipe layer (including crock, metal pipe, multi-plate or other conduits)

GROUP 6: Grouting man, audio-visual television operations and all other operations in connection with closed circuit television inspection, pipe cleaning and pipe relining work and the installation and repair of water service pipe and appurtenances

GROUP 7: Restoration laborer, seeding, sodding, planting, cutting, mulching and top soil grading; and the restoration of property such as replacing mailboxes, wood chips, planter boxes, flagstones, etc.

LABO0465-001 06/01/2024

LABORER: Highway, Bridge and Airport Construction

AREA 1: GENESEE, MACOMB, MONROE, OAKLAND, WASHTENAW AND WAYNE COUNTIES

AREA 2: ALLEGAN, BARRY, BAY, BERRIEN, BRANCH, CALHOUN, CASS, CLINTON, EATON, GRATIOT, HILLSDALE, HURON, INGHAM, JACKSON, KALAMAZOO, LAPEER, LENAWEE, LIVINGSTON, MIDLAND, MUSKEGON, SAGINAW, SANILAC, SHIAWASSEE, ST. CLAIR, ST. JOSEPH, TUSCOLA AND VAN BUREN COUNTIES

AREA 3: ALCONA, ALPENA, ANTRIM, ARENAC, BENZIE, CHARLEVOIX,

CHEBOYGAN, CLARE, CRAWFORD, EMMET, GLADWIN, GRAND TRAVERSE,
 IONIA, IOSCO, ISABELLA, KALKASKA, KENT, LAKE, LEELANAU,
 MANISTEE, MASON, MECOSTA, MISSAUKEE, MONTCALM, MONTMORENCY,
 NEWAYGO, OCEANA, OGEMAW, OSCEOLA, OSCODA, OTSEGO, OTTAWA,
 PRESQUE ISLE, ROSCOMMON AND WEXFORD COUNTIES
 AREA 4: ALGER, BARAGA, CHIPPEWA, DELTA, DICKINSON, GOGEBIC,
 HOUGHTON, IRON, KEWEENAW, LUCE, MACKINAC, MARQUETTE, MENOMINEE,
 ONTONAGON AND SCHOOLCRAFT COUNTIES

	Rates	Fringes
LABORER (AREA 1)		
GROUP 1.....	\$ 34.01	14.45
GROUP 2.....	\$ 34.14	14.45
GROUP 3.....	\$ 34.32	14.45
GROUP 4.....	\$ 34.40	14.45
GROUP 5.....	\$ 34.61	14.45
GROUP 6.....	\$ 34.91	14.45
LABORER (AREA 2)		
GROUP 1.....	\$ 31.87	14.45
GROUP 2.....	\$ 32.07	14.45
GROUP 3.....	\$ 32.31	14.45
GROUP 4.....	\$ 32.66	14.45
GROUP 5.....	\$ 32.53	14.45
GROUP 6.....	\$ 32.87	14.45
LABORER (AREA 3)		
GROUP 1.....	\$ 31.12	14.45
GROUP 2.....	\$ 31.33	14.45
GROUP 3.....	\$ 31.62	14.45
GROUP 4.....	\$ 32.06	14.45
GROUP 5.....	\$ 31.68	14.45
GROUP 6.....	\$ 32.11	14.45
LABORER (AREA 4)		
GROUP 1.....	\$ 32.02	14.45
GROUP 2.....	\$ 31.73	14.45
GROUP 3.....	\$ 32.52	14.45
GROUP 4.....	\$ 32.96	14.45
GROUP 5.....	\$ 32.58	14.45
GROUP 6.....	\$ 33.01	14.45

LABORER CLASSIFICATIONS

GROUP 1: Asphalt shoveler or loader; asphalt plant misc.;
 burlap person; yard person; dumper (wagon, truck, etc.);
 joint filling laborer; miscellaneous laborer; unskilled
 laborer; sprinkler laborer; form setting laborer; form
 stripper; pavement reinforcing; handling and placing (e.g.,
 wire mesh, steel mats, dowel bars); mason's tender or
 bricklayer's tender on manholes; manhole builder;
 headwalls, etc.; waterproofing, (other than buildings) seal
 coating and slurry mix, shoring, underpinning; pressure
 grouting; bridge pin and hanger removal; material recycling
 laborer; horizontal paver laborer (brick, concrete, clay,
 stone and asphalt); ground stabilization and modification
 laborer; grouting; waterblasting; top person; railroad
 track and trestle laborer; carpenters' tender; guard rail
 builders' tender; earth retention barrier and wall and
 M.S.E. wall installer's tender; highway and median

installer's tender(including sound, retaining, and crash barriers); fence erector's tender; asphalt raker tender; sign installer; remote control operated equipment.

GROUP 2: Mixer operator (less than 5 sacks); air or electric tool operator (jackhammer, etc.); spreader; boxperson (asphalt, stone, gravel); concrete paddler; power chain saw operator; paving batch truck dumper; tunnel mucker (highway work only); concrete saw (under 40 h.p.) and dry pack machine; roto-mill grounds person.

GROUP 3: Tunnel miner (highway work only); finishers tenders; guard rail builders; highway and median barrier installer; earth retention barrier and wall and M.S.E. wall installer's (including sound, retaining and crash barriers); fence erector; bottom person; powder person; wagon drill and air track operator; diamond and core drills; grade checker; certified welders; curb and side rail setter's tender.

GROUP 4: Asphalt raker

GROUP 5: Pipe layers, oxy-gun

GROUP 6: Line-form setter for curb or pavement; asphalt screed checker/screw man on asphalt paving machines.

LABO1076-005 04/01/2024

MICHIGAN STATEWIDE

	Rates	Fringes
LABORER (DISTRIBUTION WORK)		
Zone 1.....	\$ 27.16	13.45
Zone 2.....	\$ 25.42	13.45
Zone 3.....	\$ 23.55	13.45
Zone 4.....	\$ 22.92	13.45
Zone 5.....	\$ 22.95	13.45

DISTRIBUTION WORK - The construction, installation, treating and reconditioning of distribution pipelines transporting coal, oil, gas or other similar materials, vapors or liquids, including pipelines within private property boundaries, up to and including the meter settings on residential, commercial, industrial, institutional, private and public structures. All work covering pumping stations and tank farms not covered by the Building Trades Agreement. Other distribution lines with the exception of sewer, water and cable television are included.

Underground Duct Layer Pay: \$.40 per hour above the base pay rate.

Zone 1 - Macomb, Oakland and Wayne

Zone 2 - Monroe and Washtenaw

 Zone 3 - Bay, Genesee, Lapeer, Midland, Saginaw, Sanilac, Shiawassee and St. Clair

 Zone 4 - Alger, Baraga, Chippewa, Delta, Dickinson, Gogebic, Houghton, Iron, Keweenaw, Luce, Mackinac, Marquette, Menominee, Ontonagon and Schoolcraft

Zone 5 - Remaining Counties in Michigan

PAIN0022-002 07/01/2008

HILLSDALE, JACKSON AND LENAWEE COUNTIES; LIVINGSTON COUNTY

(east of the eastern city limits of Howell, not including the city of Howell, north to the Genesee County line and south to the Washtenaw County line); MACOMB, MONROE, OAKLAND, WASHTENAW AND WAYNE COUNTIES:

	Rates	Fringes
PAINTER.....	\$ 25.06	14.75

FOOTNOTES: For all spray work and journeyman rigging for spray work, also blowing off, \$0.80 per hour additional (applies only to workers doing rigging for spray work on off the floor work. Does not include setting up or moving rigging on floor surfaces, nor does it apply to workers engaged in covering up or tending spray equipment. For all sandblasting and spray work performed on highway bridges, overpasses, tanks or steel, \$0.80 per hour additional. For all brushing, cleaning and other preparatory work (other than spraying or steeplejack work) at scaffold heights of fifty (50) feet from the ground or higher, \$0.50 per hour additional. For all preparatorial work and painting performed on open steel under forty (40) feet when no scaffolding is involved, \$0.50 per hour additional. For all swing stage work-window jacks and window belts-exterior and interior, \$0.50 per hour additional. For all spray work and sandblaster work to a scaffold height of forty (40) feet above the floor level, \$0.80 per hour additional. For all preparatorial work and painting on all highway bridges or overpasses up to forty (40) feet in height, \$0.50 per hour additional. For all steeplejack work performed where the elevation is forty (40) feet or more, \$1.25 per hour additional.

 PAIN0312-001 06/01/2018

EXCLUDES: ALLEGAN COUNTY (Townships of Dorr, Fillmore, Heath, Hopkins, Laketown, Leighton, Manlius, Monterey, Overisel, Salem, Saugatuck and Wayland); INCLUDES: Barry, Berrien, Branch, Calhoun, Cass, Hillsdale, Kalamazoo, St. Joseph, Van Buren

	Rates	Fringes
PAINTER		
Brush and roller.....	\$ 23.74	13.35
Spray, Sandblast, Sign		
Painting.....	\$ 24.94	13.35

 PAIN0845-003 05/10/2018

CLINTON COUNTY; EATON COUNTY (does not include the townships of Bellevue and Olivet); INGHAM COUNTY; IONIA COUNTY (east of Hwy. M 66); LIVINGSTON COUNTY (west of the eastern city limits of Howell, including the city of Howell, north to the Genesee County line and south to the Washtenaw County line); AND SHIAWASSEE COUNTY (Townships of Bennington, Laingsbury and Perry):

	Rates	Fringes
PAINTER.....	\$ 25.49	13.74

 PAIN0845-015 05/10/2018

MUSKEGON COUNTY; NEWAYGO COUNTY (except the Townships of Barton, Big Prairie, Brooks, Croton, Ensley, Everett, Goodwell, Grant, Home, Monroe, Norwich and Wilcox); OCEANA COUNTY; OTTAWA COUNTY (except the townships of Allendale, Blendone, Chester, Georgetown, Holland, Jamestown, Olive, Park, Polkton, Port Sheldon, Tallmadge, Wright and Zeeland):

	Rates	Fringes
PAINTER.....	\$ 25.49	13.74

PAIN0845-018 05/10/2018

ALLEGAN COUNTY (Townships of Dorr, Fillmore, Heath, Hopkins, Laketown, Leighton, Manlius, Monterey, Overisel, Salem, Saugatuck and Wayland); IONIA COUNTY (west of Hwy. M-66); KENT, MECOSTA AND MONTCALM COUNTIES; NEWAYGO COUNTY (Townships of Barton, Big Prairie, Brooks, Croton, Ensley, Everett, Goodwell, Grant, Home, Monroe, Norwich and Wilcox); OSCEOLA COUNTY (south of Hwy. #10); OTTAWA COUNTY (Townships of Allendale, Blendone, Chester, Georgetown, Holland, Jamestown, Olive, Park, Polkton, Port Sheldon, Tallmadge, Wright and Zeeland):

	Rates	Fringes
PAINTER.....	\$ 25.49	13.74

FOOTNOTES: Lead abatement work: \$1.00 per hour additional.

PAIN1011-003 06/02/2022

ALGER, BARAGA, CHIPPEWA, DELTA, DICKINSON, GOGEBIC, HOUGHTON, IRON, KEWEENAW, LUCE, MACKINAC, MARQUETTE, MENOMINEE, ONTONAGON AND SCHOOLCRAFT COUNTIES:

	Rates	Fringes
PAINTER.....	\$ 24.66	14.99

FOOTNOTES: High pay (bridges, overpasses, watertower): 30 to 80 ft.: \$.65 per hour additional. 80 ft. and over: \$1.30 per hour additional.

PAIN1474-002 06/01/2010

HURON COUNTY; LAPEER COUNTY (east of Hwy. M-53); ST. CLAIR, SANILAC AND TUSCOLA COUNTIES:

	Rates	Fringes
PAINTER.....	\$ 23.79	12.02

FOOTNOTES: Lead abatement work: \$1.00 per hour additional.
 Work with any hazardous material: \$1.00 per hour additional. Sandblasting, steam cleaning and acid cleaning: \$1.00 per hour additional. Ladder work at or above 40 ft., scaffold work at or above 40 ft., swing stage, boatswain chair, window jacks and all work performed over a falling height of 40 ft.: \$1.00 per hour additional. Spray gun work, pick pullers and those handling needles, blowing off by air pressure, and any person rigging (setting up and moving off the ground): \$1.00 per hour additional. Steeplejack, tanks, gas holders, stacks, flag poles, radio towers and beacons, power line towers, bridges, etc.: \$1.00 per hour additional, paid from the ground up.

PAIN1803-003 06/01/2024

ALCONA, ALPENA, ANTRIM, ARENAC, BAY, BENZIE, CHARLEVOIX,

CHEBOYGAN, CLARE, CRAWFORD, EMMET, GLADWIN, GRAND TRAVERSE,
 GRATIOT, IOSCO, ISABELLA, KALKASKA, LAKE, LEELANAU, MANISTEE,
 MASON, MIDLAND, MISSAUKEE, MONTMORENCY AND OGEMAW COUNTIES;
 OSCEOLA COUNTY (north of Hwy. #10); OSCODA, OTSEGO, PRESQUE
 ISLE, ROSCOMMON, SAGINAW AND WEXFORD COUNTIES:

Rates Fringes

PAINTER

Work performed on water, bridges over water or moving traffic, radio and powerline towers, elevated tanks, steeples, smoke stacks over 40 ft. of falling heights, recovery of lead-based paints and any work associated with industrial plants, except maintenance of industrial plants.....	\$ 29.35	19.05
All other work, including maintenance of industrial plant.....	\$ 29.35	19.05

FOOTNOTES: Spray painting, sandblasting, blowdown associated
 with spraying and blasting, water blasting and work
 involving a swing stage, boatswain chair or spider: \$1.00
 per hour additional. All work performed inside tanks,
 vessels, tank trailers, railroad cars, sewers, smoke
 stacks, boilers or other spaces having limited egress not
 including buildings, opentop tanks, pits, etc.: \$1.25 per
 hour additional.

 PLAS0514-001 06/01/2023

ZONE 1: GENESEE, LIVINGSTON, MACOMB, MONROE, OAKLAND, SAGINAW,
 WASHTENAW AND WAYNE COUNTIES
 ZONE 2: ALCONA, ALGER, ALLEGAN, ALPENA, ANTRIM, ARENAC, BARAGA,
 BARRY, BAY, BENZIE, BERRIEN, BRANCH, CALHOUN, CASS, CHARLEVOIX,
 CHEBOYGAN, CHIPPEWA, CLARE, CLINTON, CRAWFORD, DELTA,
 DICKINSON, EATON, EMMET, GLADWIN, GOGEBIC, GRAND TRAVERSE,
 GRATIOT, HILLSDALE, HOUGHTON, HURON, INGHAM, IONIA, IOSCO,
 IRON, ISABELLA, JACKSON, KALAMAZOO, KALKASKA, KENT, KEWEENAW,
 LAKE, LAPEER, LEELANAU, LENAWEE, LUCE, MACKINAC, MANISTEE,
 MARQUETTE, MASON, MECOSTA, MENOMINEE, MIDLAND, MISSAUKEE,
 MONTCALM, MONTMORENCY, MUSKEGON, NEWAYGO, OCEANA, OGEMAW,
 ONTONAGON, OSCEOLA, OSCODA, OTSEGO, OTTAWA, PRESQUE ISLE,
 ROSCOMMON, SANILAC, SCHOOLCRAFT, SHIAWASSEE, ST. CLAIR, ST.
 JOSEPH, TUSCOLA, VAN BUREN AND WEXFORD COUNTIES

Rates Fringes

CEMENT MASON/CONCRETE FINISHER		
ZONE 1.....	\$ 33.00	18.51
ZONE 2.....	\$ 31.50	18.51

 PLUM0190-003 05/01/2015

ALCONA, ALGER, ALLEGAN, ALPENA, ANTRIM, ARENAC, BARAGA, BARRY,
 BAY, BENZIE, BERRIEN, BRANCH, CALHOUN, CASS, CHARLEVOIX,

CHEBOYGAN, CHIPPEWA, CLARE, CLINTON, CRAWFORD, DELTA,
 DICKINSON, EATON, EMMET, GENESEE, GLADWIN, GOGEBIC, GRAND
 TRAVERSE, GRATIOT, HILLSDALE, HOUGHTON, HURON, INGHAM, IONIA,
 IOSCO, IRON, ISABELLA, JACKSON, KALAMAZOO, KALKASKA, KENT,
 KEWEENAW, LAKE, LAPEER, LEELANAU, LENAWEE, LIVINGSTON, LUCE,
 MACKINAC, MACOMB, MANISTEE, MARQUETTE, MASON, MECOSTA,
 MENOMINEE, MIDLAND, MISSAUKEE, MONTCALM, MONTMORENCY, MONROE,
 MUSKEGON, NEWAYGO, OAKLAND, OCEANA, OGEMAW, ONTONAGON, OSCEOLA,
 OSCODA, OTSEGO, OTTAWA, PRESQUE ISLE, ROSCOMMON, SAGINAW, ST.
 CLARE, ST. JOSEPH, SANILAC, SCHOOLCRAFT, SHIAWASSEE, TUSCOLA,
 VAN BUREN, WASHTENAW, WAYNE AND WEXFORD COUNTIES

Rates Fringes

Plumber/Pipefitter - gas

distribution pipeline:

Welding in conjunction with gas distribution pipeline work.....	\$ 33.03	20.19
All other work:.....	\$ 24.19	12.28

 * TEAM0007-004 06/01/2023

AREA 1: ALCONA, ALGER, ALLEGAN, ALPENA, ANTRIM, ARENAC, BARAGA,
 BARRY, BAY, BENZIE, BERRIEN, BRANCH, CALHOUN, CASS, CHARLEVOIX,
 CHEBOYGAN, CHIPPEWA, CLARE, CLINTON, CRAWFORD, DELTA,
 DICKINSON, EATON, EMMET, GLADWIN, GOGEBIC, GRAND TRAVERSE,
 GRATIOT, HILLSDALE, HOUGHTON, HURON, INGHAM, IONIA, IOSCO,
 IRON, ISABELLA, JACKSON, KALAMAZOO, KALKASKA, KENT, KEWEENAW,
 LAKE, LAPEER, LEELANAU, LENAWEE, LUCE, MACKINAC, MANISTEE,
 MARQUETTE, MASON, MECOSTA, MENOMINEE, MIDLAND, MISSAUKEE,
 MONTCALM, MONTMORENCY, MUSKEGON, NEWAYGO, OCEANA, OGEMAW,
 ONTONAGON, OSCEOLA, OSCODA, OTSEGO, OTTAWA, PRESQUE ISLE,
 ROSCOMMON, SAGINAW, SANILAC, SCHOOLCRAFT, SHIAWASSEE, ST.
 CLAIR, ST. JOSEPH, TUSCOLA, VAN BUREN AND WEXFORD COUNTIES
 AREA 2: GENESEE, LIVINGSTON, MACOMB, MONROE, OAKLAND, WASHTENAW
 AND WAYNE COUNTIES

Rates Fringes

TRUCK DRIVER

AREA 1

Euclids, double bottoms and lowboys.....	\$ 31.55	.75 + a+b
Trucks under 8 cu. yds.....	\$ 31.30	.75 + a+b
Trucks, 8 cu. yds. and over.....	\$ 31.30	.75 + a+b

AREA 2

Euclids, double bottoms and lowboys.....	\$ 31.65	.75 + a+b
Trucks under 8 cu. yds.....	\$ 31.40	.75 + a+b
Trucks, 8 cu. yds. and over.....	\$ 31.50	.75 + a+b

Footnote:

- a. \$470.70 per week
- b. \$68.70 daily

 TEAM0247-004 04/01/2013

AREA 1: ALCONA, ALGER, ALLEGAN, ALPENA, ANTRIM, ARENAC, BARAGA,

BARRY, BAY, BENZIE, BERRIEN, BRANCH, CALHOUN, CASS, CHARLEVOIX, CHEBOYGAN, CHIPPEWA, CLARE, CLINTON, CRAWFORD, DELTA, DICKINSON, EATON, EMMET, GLADWIN, GOGEBIC, GRAND TRAVERSE, GRATIOT, HILLSDALE, HOUGHTON, HURON, INGHAM, IONIA, IOSCO, IRON, ISABELLA, JACKSON, KALAMAZOO, KALKASKA, KENT, KEWEENAW, LAKE, LAPEER, LEELANAU, LENAWEE, LUCE, MACKINAC, MANISTEE, MARQUETTE, MASON, MECOSTA, MENOMINEE, MIDLAND, MISSAUKEE, MONTCALM, MONTMORENCY, MUSKEGON, NEWAYGO, OCEANA, OGEMAW, ONTONAGON, OSCEOLA, OSCODA, OTSEGO, OTTAWA, PRESQUE ISLE, ROSCOMMON, SANILAC, SCHOOLCRAFT, SHIAWASSEE, SAGINAW, ST. CLAIR, ST. JOSEPH, TUSCOLA, VAN BUREN AND WEXFORD COUNTIES
 AREA 2: GENESEE, LIVINGSTON, MACOMB, MONROE, OAKLAND, WASHTENAW AND WAYNE COUNTIES

	Rates	Fringes
Sign Installer		
AREA 1		
GROUP 1.....	\$ 21.78	11.83
GROUP 2.....	\$ 25.27	11.8375
AREA 2		
GROUP 1.....	\$ 22.03	11.83
GROUP 2.....	\$ 25.02	11.8375

FOOTNOTE:

a. \$132.70 per week, plus \$17.80 per day.

SIGN INSTALLER CLASSIFICATIONS:

GROUP 1: performs all necessary labor and uses all tools required to construct and set concrete forms required in the installation of highway and street signs
 GROUP 2: performs all miscellaneous labor, uses all hand and power tools, and operates all other equipment, mobile or otherwise, required for the installation of highway and street signs

 TEAM0247-010 04/01/2018
 AREA 1: LAPEER AND SHIAWASSEE COUNTIES
 AREA 2: GENESEE, MACOMB, MONROE, OAKLAND, ST. CLAIR, WASHTENAW AND WAYNE COUNTIES

	Rates	Fringes
TRUCK DRIVER (Underground construction)		
AREA 1		
GROUP 1.....	\$ 23.82	19.04
GROUP 2.....	\$ 23.91	19.04
GROUP 3.....	\$ 24.12	19.04
AREA 2		
GROUP 1.....	\$ 24.12	19.04
GROUP 2.....	\$ 24.26	19.04
GROUP 3.....	\$ 24.45	19.04

PAID HOLIDAYS: New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day.

SCOPE OF WORK: Excavation, site preparation, land balancing, grading, sewers, utilities and improvements; also including but not limited to, tunnels, underground piping, retention, oxidation, flocculation facilities, conduits, general

excavation and steel sheeting for underground construction. Underground construction work shall not include any structural modifications, alterations, additions and repairs to buildings or highway work, including roads, streets, bridge construction and parking lots or steel erection.

TRUCK DRIVER CLASSIFICATIONS

GROUP 1: Truck driver on all trucks (EXCEPT dump trucks of 8 cubic yards capacity or over, pole trailers, semis, low boys, Euclid, double bottom and fuel trucks)

GROUP 2: Truck driver on dump trucks of 8 cubic yards capacity or over, pole trailers, semis and fuel trucks

GROUP 3: Truck driver on low boy, Euclid and double bottom

 * SUMI2002-001 05/01/2002

	Rates	Fringes
FLAG PERSON.....	\$ 10.10 **	0.00
 LINE PROTECTOR (ZONE 1: GENESEE, MACOMB, MONROE, OAKLAND, WASHTENAW AND WAYNE)....	 \$ 22.89	 13.45
 LINE PROTECTOR (ZONE 2: STATEWIDE (EXCLUDING GENESEE, MACOMB, MONROE, OAKLAND, WASHTENAW AND WAYNE).....	 \$ 20.19	 13.45
 Pavement Marking Machine (ZONE 1: GENESEE, MACOMB, MONROE, OAKLAND, WASHTENAW AND WAYNE COUNTIES) Group 1.....	 \$ 30.52	 13.45
 Pavement Marking Machine (ZONE 1: GENESEE, MACOMB, MONROE, OAKLAND, WASHTENAW AND WAYNE) Group 2.....	 \$ 27.47	 13.45
 Pavement Marking Machine (ZONE 2: STATEWIDE (EXCLUDING GENESEE, MACOMB, MONROE, OAKLAND, WASHTENAW AND WAYNE COUNTIES) Group 1.....	 \$ 26.92	 13.45
 Pavement Marking Machine (ZONE 2: STATEWIDE (EXCLUDING GENESEE, MACOMB, MONROE, OAKLAND, WASHTENAW AND WAYNE) Group 2.....	 \$ 24.23	 13.45

WORK CLASSIFICATIONS:

PAVEMENT MARKER GROUP 1: Drives or operates a truck mounted striper, grinder, blaster, groover, or thermoplastic melter

for the placement or removal of temporary or permanent pavement markings or markers.

PAVEMENT MARKER GROUP 2: Performs all functions involved for the placement or removal of temporary or permanent pavement markings or markers not covered by the classification of Pavement Marker Group 1 or Line Protector.

LINE PROTECTOR: Performs all operations for the protection or removal of temporary or permanent pavement markings or markers in a moving convoy operation not performed by the classification of Pavement Marker Group 1. A moving convoy operation is comprised of only Pavement Markers Group 1 and Line Protectors.

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.
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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 (\$17.20) or 13658 (\$12.90). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year.

Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at

<https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate

(weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier. Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier. A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

State Adopted Rate Identifiers

Classifications listed under the "SA" identifier indicate that the prevailing wage rate set by a state (or local) government was adopted under 29 C.F.R. §1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME

refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 01/03/2024 reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"

Federal Provisions Addendum

This addendum applies to purchases that will be paid for in whole or in part with funds obtained from the federal government. The provisions below are required and the language is not negotiable. If any provision below conflicts with the State's terms and conditions, including any attachments, schedules, or exhibits to the State's Contract, the provisions below take priority to the extent a provision is required by federal law; otherwise, the order of precedence set forth in the Contract applies. Hyperlinks are provided for convenience only; broken hyperlinks will not relieve Contractor from compliance with the law.

1. Equal Employment Opportunity

If this Contract is a "federally assisted construction contract" as defined in [41 CFR Part 60-1.3](#), and except as otherwise may be provided under [41 CFR Part 60](#), then during performance of this Contract, the Contractor agrees as follows:

(1) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following:

Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

(2) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.

(3) The Contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the Contractor's legal duty to furnish information.

(4) The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the Contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(5) The Contractor will comply with all provisions of [Executive Order 11246](#) of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(6) The Contractor will furnish all information and reports required by [Executive Order 11246](#) of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(7) In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this Contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in [Executive Order 11246](#) of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in [Executive Order 11246](#) of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(8) The Contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of [Executive Order 11246](#) of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance:

Provided, however, that in the event a Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

The applicant further agrees that it will be bound by the above equal opportunity clause with respect to its own employment practices when it participates in federally assisted construction work: *Provided*, That if the applicant so participating is a State or local government, the above equal opportunity clause is not applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the contract.

The applicant agrees that it will assist and cooperate actively with the administering agency and the Secretary of Labor in obtaining the compliance of contractors and subcontractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor, that it will furnish the administering agency and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist the administering agency in the discharge of the agency's primary responsibility for securing compliance.

The applicant further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, with a contractor debarred from, or who has not demonstrated eligibility for, Government contracts and federally assisted construction contracts pursuant to the Executive Order and will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon contractors and subcontractors by the administering agency or the Secretary of Labor pursuant to Part II, Subpart D of the Executive Order. In addition, the applicant agrees that if it fails or refuses to comply with these undertakings, the administering agency may take any or all of the following actions: Cancel, terminate, or suspend in whole or in part this grant (contract, loan, insurance, guarantee); refrain from extending any further assistance to the applicant under the program with respect to which the failure or refund occurred until satisfactory assurance of future compliance has been received from such applicant; and refer the case to the Department of Justice for appropriate legal proceedings.

2. Davis-Bacon Act (Prevailing Wage)

If this Contract is a **prime construction contracts** in excess of \$2,000, the Contractor (and its Subcontractors) must comply with the Davis-Bacon Act ([40 USC 3141-3148](#)) as supplemented by Department of Labor regulations ([29 CFR Part 5](#), "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction"), and during performance of this Contract the Contractor agrees as follows:

- (1) All transactions regarding this contract shall be done in compliance with the Davis-Bacon Act (40 U.S.C. 3141- 3144, and 3146-3148) and the requirements of 29 C.F.R. pt. 5 as may be applicable. The contractor shall comply with 40 U.S.C. 3141-3144, and 3146-3148 and the requirements of 29 C.F.R. pt. 5 as applicable.
- (2) Contractors are required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor.

- (3) Additionally, contractors are required to pay wages not less than once a week.

3. Copeland "Anti-Kickback" Act

If this Contract is a contract for construction or repair work in excess of \$2,000 where the Davis-Bacon Act applies, the Contractor must comply with the Copeland "Anti-Kickback" Act ([40 USC 3145](#)), as supplemented by Department of Labor regulations ([29 CFR Part 3](#), "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"), which prohibits the Contractor and subrecipients from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled, and during performance of this Contract the Contractor agrees as follows:

- (1) Contractor. The Contractor shall comply with 18 U.S.C. §874, 40 U.S.C. § 3145, and the requirements of 29 C.F.R. pt. 3 as may be applicable, which are incorporated by reference into this contract.
- (2) Subcontracts. The Contractor or Subcontractor shall insert in any subcontracts the clause above and such other clauses as FEMA or the applicable federal awarding agency may by appropriate instructions require, and also a clause requiring the Subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all of these contract clauses.
- (3) Breach. A breach of the contract clauses above may be grounds for termination of the contract, and for debarment as a Contractor and Subcontractor as provided in 29 C.F.R. § 5.12.

4. Contract Work Hours and Safety Standards Act

If the Contract is **in excess of \$100,000** and **involves the employment of mechanics or laborers**, the Contractor must comply with [40 USC 3702](#) and [3704](#), as supplemented by Department of Labor regulations ([29 CFR Part 5](#)), as applicable, and during performance of this Contract the Contractor agrees as follows:

- (1) Overtime requirements. No Contractor or Subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.
- (2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1) of this section the Contractor and any Subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such Contractor and Subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this section, in the sum of \$27 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1) of this section.
- (3) Withholding for unpaid wages and liquidated damages. The State shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or Subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this section.

- (4) Subcontracts. The Contractor or Subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1) through (4) of this section and also a clause requiring the Subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1) through (4) of this section.

5. Rights to Inventions Made Under a Contract or Agreement

If the Contract is funded by a federal "funding agreement" as defined under [37 CFR §401.2 \(a\)](#) and the recipient or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that "funding agreement," the recipient or subrecipient must comply with [37 CFR Part 401](#), "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the awarding agency.

6. Clean Air Act and the Federal Water Pollution Control Act

If this Contract is **in excess of \$150,000**, the Contractor must comply with all applicable standards, orders, and regulations issued under the Clean Air Act ([42 USC 7401-7671q](#)) and the Federal Water Pollution Control Act ([33 USC 1251-1387](#)), and during performance of this Contract the Contractor agrees as follows:

Clean Air Act

1. The Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. § 7401 et seq.
2. The Contractor agrees to report each violation to the State and understands and agrees that the State will, in turn, report each violation as required to assure notification to the Federal Emergency Management Agency or the applicable federal awarding agency, and the appropriate Environmental Protection Agency Regional Office.
3. The Contractor agrees to include these requirements in each subcontract exceeding \$150,000 financed in whole or in part with Federal assistance provided by FEMA or the applicable federal awarding agency.

Federal Water Pollution Control Act

1. The Contractor agrees to comply with all applicable standards, orders, or regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 et seq.
2. The Contractor agrees to report each violation to the State and understands and agrees that the State will, in turn, report each violation as required to assure notification to the Federal Emergency Management Agency or the applicable federal awarding agency, and the appropriate Environmental Protection Agency Regional Office.
3. The Contractor agrees to include these requirements in each subcontract exceeding \$150,000 financed in whole or in part with Federal assistance provided by FEMA or the applicable federal awarding agency.

7. Debarment and Suspension

A “contract award” (see [2 CFR 180.220](#)) must not be made to parties listed on the government-wide exclusions in the [System for Award Management](#) (SAM), in accordance with the OMB guidelines at [2 CFR 180](#) that implement [Executive Orders 12549](#) (51 FR 6370; February 21, 1986) and 12689 (54 FR 34131; August 18, 1989), “Debarment and Suspension.” SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than [Executive Order 12549](#).

- (1) This Contract is a covered transaction for purposes of 2 C.F.R. pt. 180 and 2 C.F.R. pt. 3000. As such, the Contractor is required to verify that none of the Contractor’s principals (defined at 2 C.F.R. § 180.995) or its affiliates (defined at 2 C.F.R. § 180.905) are excluded (defined at 2 C.F.R. § 180.940) or disqualified (defined at 2 C.F.R. § 180.935).
- (2) The Contractor must comply with 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C, and must include a requirement to comply with these regulations in any lower tier covered transaction it enters into.
- (3) This certification is a material representation of fact relied upon by the State. If it is later determined that the contractor did not comply with 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C, in addition to remedies available to the State, the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment.
- (4) The bidder or proposer agrees to comply with the requirements of 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C while this offer is valid and throughout the period of any contract that may arise from this offer. The bidder or proposer further agrees to include a provision requiring such compliance in its lower tier covered transactions.

8. Byrd Anti-Lobbying Amendment

Contractors who apply or bid for an award of **\$100,000 or more** shall file the required certification in Exhibit 1 – Byrd Anti-Lobbying Certification below. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, officer or employee of Congress, or an employee of a Member of Congress in connection with obtaining any Federal contract, grant, or any other award covered by 31 U.S.C. § 1352. Each tier shall also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the recipient who in turn will forward the certification(s) to the awarding agency.

9. Procurement of Recovered Materials

Under [2 CFR 200.322](#), Contractors must comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act.

- (1) In the performance of this contract, the Contractor shall make maximum use of products containing recovered materials that are EPA-designated items unless the product cannot be acquired—
 1. Competitively within a timeframe providing for compliance with the contract performance schedule;
 2. Meeting contract performance requirements; or
 3. At a reasonable price.

- (2) Information about this requirement, along with the list of EPA- designated items, is available at EPA's Comprehensive Procurement Guidelines web site, <https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program>.
- (3) The Contractor also agrees to comply with all other applicable requirements of Section 6002 of the Solid Waste Disposal Act.

10. Additional FEMA Contract Provisions.

The following provisions apply to purchases that will be paid for in whole or in part with funds obtained from the Federal Emergency Management Agency (FEMA):

- (1) Access to Records. The following access to records requirements apply to this contract:
 - a. The Contractor agrees to provide the State, the FEMA Administrator, the Comptroller General of the United States, or any of their authorized representatives access to any books, documents, papers, and records of the Contractor which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts, and transcriptions.
 - b. The Contractor agrees to permit any of the foregoing parties to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.
 - c. The Contractor agrees to provide the FEMA Administrator or his authorized representatives access to construction or other work sites pertaining to the work being completed under the contract.
 - d. In compliance with the Disaster Recovery Act of 2018, the State and the Contractor acknowledge and agree that no language in this contract is intended to prohibit audits or internal reviews by the FEMA Administrator or the Comptroller General of the United States.

- (2) Changes.

See the provisions regarding modifications or change notice in the Contract Terms.

- (3) DHS Seal, Logo, And Flags

The Contractor shall not use the DHS seal(s), logos, crests, or reproductions of flags or likenesses of DHS agency officials without specific FEMA pre-approval.

- (4) Compliance with Federal Law, Regulations, and Executive Orders

This is an acknowledgement that FEMA financial assistance will be used to fund all or a portion of the contract. The Contractor will comply with all applicable Federal law, regulations, executive orders, FEMA policies, procedures, and directives.

- (5) No Obligation by Federal Government

The Federal Government is not a party to this contract and is not subject to any obligations or liabilities to the State, Contractor, or any other party pertaining to any matter resulting from the Contract."

(6) Program Fraud and False or Fraudulent Statements or Related Acts

The Contractor acknowledges that 31 U.S.C. Chap. 38 (Administrative Remedies for False Claims and Statements) applies to the Contractor's actions pertaining to this contract.

Exhibit 1 - Byrd Anti-Lobbying Certification

Contractor must complete this certification if the purchase will be paid for in whole or in part with funds obtained from the federal government and the purchase is greater than \$100,000.

APPENDIX A, 44 C.F.R. PART 18 – CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

The Contractor, _____, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. Chap. 38, Administrative Remedies for False Claims and Statements, apply to this certification and disclosure, if any.

Signature of Contractor's Authorized Official

Name and Title of Contractor's Authorized Official

Date

§ 200.322 Domestic Preferences for Procurements

- (a) As appropriate and to the extent consistent with law, the non-Federal entity should, to the greatest extent practicable under a Federal award, provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products). The requirements of this section must be included in all subawards including all contracts and purchase orders for work or products under this award.
- (b) For purposes of this section:
- (1) "Produced in the United States" means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.
 - (2) "Manufactured products" means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.

FEDERAL STATE and LOCAL FISCAL RECOVERY FUNDS (SLFRF) PROJECT SPECIFIC REQUIREMENTS

The funding being used for this project is Federal State and Local Fiscal Recovery Funds (SLFRF). As a result, additional provisions apply and are included in this Attachment.

Each primary contracted contractor with the DTMB must register with the Federal System for Award Management (SAM) must register prior to contract execution. The SAM website is <https://sam.gov/content/home>. The direct hyperlink for SAM.gov registration is <https://sam.gov/content/entity-registration>

As of April 4, 2022, the Federal government will use a Unique Entity Identifier (UEI) created in SAM.gov as the official subrecipient identifier. All primary contracted contractors with the DTMB will be required to maintain an active registration on SAM.gov. To receive payment, all primary contracted vendors need to have a Unique Entity Identifier (UEI) number and have the UEI entered in their SIGMA account. Information on the UEI and sign up can be obtained at: <https://www.gsa.gov/about-us/organization/federal-acquisition-service/office-of-systems-management/integrated-award-environment-iae/iae-systems-information-kit/unique-entity-identifier-update>

Contractor is to fill in and provide the following documentation for use in SLFRF reporting prior to Contract Execution for use in the reporting requirements:

Contractor's UEI _____

Contractor's Full Legal Name _____

Primary Point-of-Contact Email Address _____

Business Address _____

City Business is located _____

State Business is located _____

US Zip Code + 4 digits _____