

TECHNICAL SPECIFICATIONS
April 28, 2025 - BIDDING

**GLADWIN TRANSPORTATION
MAINTENANCE ADDITION**

FOR

GLADWIN CITY / COUNTY TRANSIT

PREPARED BY

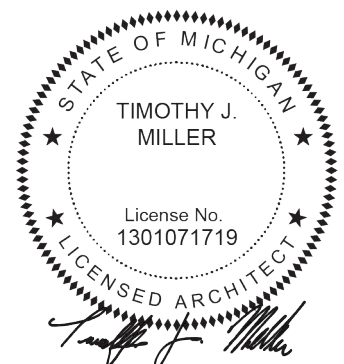


Sidock Group, Inc.

ENGINEERS • ARCHITECTS • CONSULTANTS • PROJECT MANAGERS

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PROJECT NO. 521558



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ATTACHMENTS

Prein & Newhof Geotechnical Investigation Report

State of Michigan Wage determination

END OF SECTION

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CS-002	STATEMENT OF SPECIAL INSPECTIONS, ABBREVIATIONS, DRAWING LEGEND

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GLAWIN TRANSPORTATION	
MAINTENANCE EXPANSION	
Project #521558	

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END OF SECTION

SECTION 00 3132
GEOTECHNICAL AND ENVIRONMENTAL DATA

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION

- A. Soil investigation report dated 11/24/2021 has been prepared by Prein & Newhof hereinafter referred to as the Soil Engineer. A copy of this report is attached for reference only.
- B. Reports were obtained only for the Owner's use in design and is not a part of the Contract Documents.
- C. The reports are for Contractor's information but are not a warrant of subsurface condition (Soils Report). None of the information listed therein is guaranteed by the Owner or Architect as being uniformly representative of the soil and water conditions which may be encountered.

The Contractor may formulate his own conclusions for bidding purposes from such information and from his inspection of the site.

1.03 ADDITIONAL INFORMATION

- A. The Contractor should visit the site and acquaint himself with all existing conditions. Prior to bidding, bidders may take their own subsurface investigations, but such subsurface investigations shall be performed only under time schedules and arrangements approved in advance by the General Contractor.

END OF SECTION

**SECTION 01 1000
SUMMARY**

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: Gladwin Transportation Maintenance Expansion
- B. Owner's Name: Gladwin City and County Transit
Gladwin, Michigan
- C. Architect's Name: Sidock Group, Inc..
757 S. Wisconsin
Gaylord, Michigan 49735
(989) 705-8400
- D. Contractor's Name: TBD
- E. The Project consists of the remodeling of existing maintenance facility.

1.02 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract.
 - 1. As provided by MDOT

1.03 CONTRACTOR USE OF SITE AND PREMISES

- A. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 2300
ALTERNATES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for pricing Alternates.

1.02 ACCEPTANCE OF ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

PART 2 PRODUCTS/ALTERNATES –

Renovation: Alternate E1: Provide the cost to replace the interiors, including breakers and the covers for Panels MDP and LPA.

Addition: Alternate E1: Provide the cost to directional bore and provide 2-1/2" conduit for new communications cables between the buildings in lieu of reusing existing conduit.

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 2500
SUBSTITUTION PROCEDURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.03 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
 - 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
 - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
 - 1. Note explicitly any non-compliant characteristics.
- C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
- D. Limit each request to a single proposed substitution item.
 - 1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.

3.03 ACCEPTANCE

- A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.04 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

END OF SECTION

SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Preconstruction meeting.
- C. Progress meetings.
- D. Construction progress schedule.
- E. Progress photographs.
- F. Submittals for review, information, and project closeout.
- G. Number of copies of submittals.
- H. Requests for Interpretation (RFI) procedures.
- I. Submittal procedures.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements: General product requirements.
- B. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 REFERENCE STANDARDS

- A. AIA G716 - Request for Information.

1.04 PROJECT COORDINATOR

- A. Project Coordinator: Construction Manager.
- B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for vehicle access, traffic, and parking facilities.
- C. During construction, coordinate use of site and facilities through the Project Coordinator.
- D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 1000 - Summary.
- F. Coordinate field engineering and layout work under instructions of the Project Coordinator.
- G. Make the following types of submittals to Architect through the Project Coordinator:
 - 1. Requests for Interpretation.
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - 9. Coordination drawings.
 - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. Schedule meeting after Notice of Award.
- B. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
- C. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.
 - 4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 - 5. Submission of initial Submittal schedule.
 - 6. Designation of personnel representing the parties to Contract and Architect.
 - 7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - 8. Scheduling.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.02 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at intervals determined by the agreement.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required:
 - 1. Contractor.
 - 2. Owner.
 - 3. Architect.
 - 4. Contractor's superintendent.
 - 5. Major subcontractors.
- D. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review of work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems that impede, or will impede, planned progress.
 - 5. Review of submittals schedule and status of submittals.
 - 6. Review of RFIs log and status of responses.
 - 7. Review of off-site fabrication and delivery schedules.
 - 8. Maintenance of progress schedule.
 - 9. Corrective measures to regain projected schedules.
 - 10. Planned progress during succeeding work period.
 - 11. Coordination of projected progress.
 - 12. Maintenance of quality and work standards.
 - 13. Effect of proposed changes on progress schedule and coordination.
 - 14. Other business relating to work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 CONSTRUCTION PROGRESS SCHEDULE

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.

3.04 PROGRESS PHOTOGRAPHS

- A. Submit new photographs at least once a month, within 3 days after being taken.
- B. Photography Type: Digital; electronic files.
- C. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.
- D. In addition to periodic, recurring views, take photographs of each of the following events:
 - 1. Structural framing in progress and upon completion.
 - 2. Enclosure of building, upon completion.
 - 3. Final completion, minimum of ten (10) photos.
- E. Views:
 - 1. Provide factual presentation.
 - 2. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

3.05 REQUESTS FOR INTERPRETATION (RFI)

- A. Definition: A request seeking one of the following:
 - 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
 - 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 - 1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 - 2. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- C. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
 - 1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
 - 2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::

- a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section - 01 6000 - Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
- 3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response.
- 4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response.
 - a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.
- D. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
 - 1. Official Project name and number, and any additional required identifiers established in Contract Documents.
 - 2. Owner's, Architect's, and Contractor's names.
 - 3. Discrete and consecutive RFI number, and descriptive subject/title.
 - 4. Issue date, and requested reply date.
 - 5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 - 6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
- E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- F. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 - 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 - 2. Note dates of when each request is made, and when a response is received.
- G. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
 - 1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- H. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
 - 1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
 - 2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
 - 3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
 - 4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.06 SUBMITTAL SCHEDULE

- A. Submit to Architect for review a schedule for submittals in tabular format.
 - 1. Coordinate with Contractor's construction schedule and schedule of values.

3.07 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 - 1. Product data.
 - 2. Shop drawings.
 - 3. Samples for selection.
 - 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.08 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 - 1. Design data.
 - 2. Certificates.
 - 3. Test reports.
 - 4. Inspection reports.
 - 5. Manufacturer's instructions.
 - 6. Manufacturer's field reports.
- B. Submit for Architect's knowledge as contract administrator or for Owner.

3.09 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
 - 1. Project record documents.
 - 2. Operation and maintenance data.
 - 3. Warranties.
 - 4. Bonds.
 - 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.10 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
 - 1. After review, produce duplicates.
 - 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.11 SUBMITTAL PROCEDURES

- A. General Requirements:
 - 1. Use a separate transmittal for each item.

2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
 3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
 4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
 6. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
 - a. Send submittals in electronic format via email to Architect.
 7. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
 - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
 - c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
 8. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 9. Provide space for Contractor and Architect review stamps.
 10. When revised for resubmission, identify all changes made since previous submission.
 11. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
 12. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
- B. Product Data Procedures:
1. Submit only information required by individual specification sections.
 2. Collect required information into a single submittal.
 3. Submit concurrently with related shop drawing submittal.
 4. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
 2. Do not reproduce Contract Documents to create shop drawings.
 3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
1. Transmit related items together as single package.
 2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

3.12 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

END OF SECTION

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Control of installation.
- F. Tolerances.
- G. Manufacturers' field services.
- H. Defect Assessment.

1.02 REFERENCE STANDARDS

- A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants.
- B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
- C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry.
- D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
- F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing.
- G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components.
- H. IAS AC89 - Accreditation Criteria for Testing Laboratories.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Compliance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
 - 2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

- D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
 - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
 - 1. Submit report in duplicate within 30 days of observation to Architect for information.
 - 2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
- G. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
 - 1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
 - 2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
 - 1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
- B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- C. Contractor's Quality Control (CQC) Plan:
 - 1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
 - a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority. Include qualifications (in resume form), duties, responsibilities of each person assigned to CQC function.
 - b. Owner will not make a separate payment for providing and maintaining a Quality Control Plan. Include associated costs in Bid price.
 - c. Acceptance of the plan is required prior to start of construction activities not including mobilization work. Owner's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. Owner reserves the right to require Contractor to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results.
- D. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.

1.05 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with

requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.06 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Contractor shall employ and pay for services of an independent testing agency to perform specified testing and inspection.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- C. Contractor Employed Agency:
 - 1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
 - 2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
 - 3. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
 - 4. Laboratory: Authorized to operate in the State in which the Project is located.
 - 5. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
 - 6. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.03 TESTING AND INSPECTION

- A. Testing Agency Duties:
 - 1. Test samples of mixes submitted by Contractor.
 - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified standards.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 - 6. Perform additional tests and inspections required by Architect.
 - 7. Attend preconstruction meetings and progress meetings.
 - 8. Submit reports of all tests/inspections specified.
 - B. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
 - C. Contractor Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 - 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 - 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 - 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 - D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
 - E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.
 - F. Provide patching and restoration services where test samples have been removed, complying with individual technical sections
 - G. Except for specialized laboratory sampling equipment, and except as otherwise indicated, supply and operate tools and construction equipment needed to obtain test samples from the work, including cutting devices for sawing, drilling, flame cutting, coring and similar operations. Assist agencies in labeling and packaging of test samples removed from the work.
- Coordination with Contractor's Independent Agencies: Except for required independent agency activities of inspection, measuring, testing, analyzing, reporting and similar activities, the

assignment of labor, equipment, cutting, patching and similar necessary activities associated therewith are Contractor's option recognizing that entire activity is Contractor's responsibility.

- H. Coordination with Contractor's Independent Agencies: Except for required independent agency activities of inspection, measuring, testing, analyzing, reporting and similar activities, the assignment of labor, equipment, cutting, coring and similar operations. Assist agencies in labeling and packaging of test samples removed from the work.

3.04 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.05 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.
- B. If, in the opinion of Owner, it is not practical to remove and replace the work, Owner will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 4100
REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY OF REFERENCE STANDARDS

- A. Regulatory requirements applicable to this project are the following:
- B. ABAA – Air Barrier System (Section 01 4110)
- C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- D. 29 CFR 1910 - Occupational Safety and Health Standards.
- E. State of Michigan amendments to some or all of the following.
- F. ICC A117.1 - Accessible and Usable Buildings and Facilities.
- G. ICC (IFC) - International Fire Code.
- H. NFPA 1 - Fire Code.
- I. NFPA 101 - Life Safety Code.
- J. ICC (IBC) - International Building Code.
- K. ICC (IPC) - International Plumbing Code.
- L. ICC (IMC) - International Mechanical Code.
- M. ICC (IFGC) - International Fuel Gas Code.
- N. ICC (IPSDC) - International Private Sewage Disposal Code.
- O. NFPA 70 - National Electrical Code.
- P. ICC (IECC) - International Energy Conservation Code.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 4110
THE AIR BARRIER SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section includes administrative and procedural requirements for accomplishing an airtight building enclosure that controls infiltration or exfiltration of air.
 - 1. The airtight components of the building enclosure and the joints, junctures and transitions between materials, products, and assemblies forming the air-tightness of the building enclosure are called "the air barrier system". Services include coordination between the trades, the proper scheduling and sequencing of the work, preconstruction meetings, inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Architect.
 - 2. The Contractor shall ensure that the intent of constructing the building enclosure with a continuous air barrier system to control air leakage into, or out of the conditioned space is achieved. The air barrier system shall have the following characteristics:
 - a. It must be continuous, with all joints sealed.
 - b. It must be structurally supported to withstand positive and negative air pressures applied to the building enclosure.
 - c. Connection shall be made between:
 - 1) Foundation and walls.
 - 2) Walls and windows or doors.
 - 3) Different wall systems.
 - 4) Wall and roof.
 - 5) Wall and roof over unconditioned space.
 - 6) Walls, floor and roof across construction, control and expansion joints.
 - 7) Walls, floors and roof to utility, pipe and duct penetrations.
 - 3. Air Barrier Penetrations: All penetrations of the air barrier and paths of air infiltration / exfiltration shall be sealed.
- B. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.
- C. Requirements of this section relate to the coordination between subcontractors required to provide an airtight building enclosure, customized fabrication and installation procedures, not production of standard products.
 - 1. Continuity of the air barrier materials and products with joints to provide assemblies. Continuity of all the enclosure assemblies with joints and transition materials to provide a whole building air barrier system.
 - 2. Specific quality-control requirements for individual construction activities are specified in the sections of the specifications. Requirements in those sections may also cover production of standard products. It is the Contractor's responsibility to ensure that each subcontractor is adequately and satisfactorily performing the quality assurance documentation, tests and procedures required by each section.
 - 3. Specified inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.
 - 4. Requirements for Contractor to provide an airtight building enclosure is not limited by quality-control services required by Architect, Owner, or authorities having jurisdiction and are not limited by provisions of this section.

1.2 RELATED SECTIONS

- A. Division 1 Section Quality Control
- B. Division 1 Section Schedule

- C. Division 1 Section Meetings
- D. Division 3 Section Concrete
- E. Division 3 Section Precast Concrete
- F. Division 5 Section Light Gauge Metal Framing
- G. Division 6 Section Wood Sheathing
- H. Division 7 Section Roofing
- I. Division 7 Section Air Barrier
- J. Division 7 Section Sealants
- K. Division 8 Section Windows
- L. Division 8 Section Exterior Doors
- M. Division 8 Section Curtain Walls
- N. Division 8 Section Revolving Doors
- O. Division 8 Section Skylights
- P. Division 8 Section Storefronts and Entrances.
- Q. Division 8 Section Loading Dock Rollup-up Doors

1.3 RESPONSIBILITIES

- A. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide coordination of the trades, and the sequence of construction to ensure continuity of the air barrier system joints, junctures and transitions between materials and assemblies of materials and products, from substructure to walls to roof. Provide quality assurance procedures, testing and verification as specified herein. Facilitate inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction or by the Owner. Costs for these services are included in the Contract Sum.
 - 1. Organize preconstruction meetings between the trades involved in the whole building's air barrier system to discuss where each trade begins and ends and the responsibility and sequence of installation of all the air-tight joints, junctures, and transitions between materials, products and assemblies of products specified in the different sections, to be installed by the different trades.
 - 2. Build a mock-up before proceeding with the work, satisfactory to the Architect, of each air-tight joint type, juncture, and transition between products, materials and assemblies.
- B. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:
 - 1. Provide access to the Work.
 - 2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
 - 3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
 - 4. Deliver samples to testing laboratories.
 - 5. Provide security and protection of samples and test equipment at the Project Site.
- C. Duties of the Testing and Inspection Agency: The independent agency engaged to perform inspections, sampling, and testing of air barrier materials, components and assemblies specified in individual Sections shall cooperate with the Architect and the Contractor in performance of the agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.
 - 1. The agency shall notify the Architect and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.
 3. The agency shall not perform any duties of the Contractor.
- D. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

1.4 PERFORMANCE REQUIREMENTS

- A. Compliance Alternatives:
- a. Materials: materials used for the air barrier system in the opaque envelope shall have an air permeance not to exceed 0.004 cfm/ft² under a pressure differential of 0.3 in. water (1.57psf) (0.02 L/s.m² @ 75 Pa) when tested in accordance with ASTM E 2178. Or,
 - b. Assemblies of materials and components: shall have an air permeance not to exceed 0.04 cfm/ft² under a pressure differential of 0.3 in. water (1.57psf) (0.2 L/s.m² @ 75 Pa) when tested in accordance with ASTM E 2357. Or:
 - c. The entire building: The air leakage of the entire building shall not exceed 0.4 cfm/ft² under a pressure differential of 0.3 in. water (1.57psf) (2.0 L/s.m² @ 75 Pa) when tested according to ASTM E 779.

1.5 SUBMITTALS

- A. Unless the Contractor is responsible for this service, the independent testing agency shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Architect. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection, test, or similar service through the Contractor.
1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
 2. Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address, and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making the inspection or test.
 - f. Designation of the Work and test method.
 - g. Identification of product and Specification Section.
 - h. Complete inspection or test data.
 - i. Test results and an interpretation of test results.
 - j. Ambient conditions at the time of sample taking and testing.
 - k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
 - l. Name and signature of laboratory inspector.
 - m. Recommendations on retesting.

1.6 QUALITY ASSURANCE

- A. Qualifications for Air Barrier Testing and Inspection Agencies: Engage air Barrier inspection and testing service agencies, including independent testing laboratories, that are prequalified and that specialize in the types of air barrier system inspections and tests to be performed.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

- A. Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.
- C. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

3.2 TESTING AND INSPECTION

- A. The Owner will hire a testing and inspection agency to provide [Continuous] [Occasional] observation and inspection during installation of the air barrier system. The testing and inspection agency will provide the following listed services:

- 1. Qualitative Testing and Inspection:
 - a. Daily reports of observations, with copies to the Owner, Contractor and Architect.
 - b. Continuity of the air barrier system throughout the building enclosure with no gaps, holes.
 - c. Structural support of the air barrier system to withstand design air pressures.
 - d. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions and mortar droppings.
 - e. Site conditions for application temperature and dryness of substrates.
 - f. Maximum length of exposure time of materials to ultra-violet deterioration.
 - g. Surfaces are properly primed.
 - h. Laps in material are 2" minimum, shingled in the correct direction (or mastic applied on exposed edges), with no fish-mouths.
 - i. Mastic applied on cut edges.
 - j. Roller has been used to enhance adhesion.
 - k. Measure application thickness of liquid-applied materials to manufacturer's specifications for the specific substrate.
 - l. Materials used for compatibility.
 - m. Transitions at changes in direction, and structural support at gaps.
 - n. Connections between assemblies (membrane and sealants) for cleaning, preparation and priming of surfaces, structural support, integrity and continuity of seal.
 - o. All penetrations sealed.
 - p. ASTM E 1186 "Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Retarder Systems."
 - 1) Infrared scanning with pressurization/depressurization.
 - 2) Smoke pencil with pressurization/depressurization.
 - 3) Pressurization/depressurization with use of anemometer
 - 4) Generated sound with sound detection
 - 5) Tracer gas measurement of decay rate
 - 6) Chamber pressurization/depressurization in conjunction with smoke tracers
 - 7) Chamber depressurization using detection liquids
- 2. Quantitative tests:
 - a. Provide written test reports of all tests performed, with copies to the Owner, Contractor and Architect.
 - b. Material compliance for maximum air permeance, ASTM E 2178.
 - c. ASTM E 283, Determining rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across the Specimen.

- d. Assemblies, ASTM E 2357, test pressure and allowable air leakage rate to be determined by design professional for interior design conditions and location of project.
- e. CAN/CGSB 1986 Standard 149.10, Determination of the Airtightness of Building Envelopes by the Fan Depressurization Method.
- f. CAN/CGSB 1996 Standard 149.15 Determination of the Overall Envelope Airtightness of Office Buildings by the Fan Depressurization Method Using the Building's Air Handling System.
- g. Whole building, floors, or suites, ASTM E779, Determining Airtightness of Buildings Air Leakage Rate by Single Zone Air Pressurization.
- h. Windows and connections to adjacent opaque assemblies, ASTM E783 method B
- i. Tracer gas testing, ASTM E741
- j. Pressure test, ASTM E330
- k. Bond to substrate, ASTM D4541

END OF SECTION

SECTION 01 4533
CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Code-required special inspections.
- B. Testing services incidental to special inspections.
- C. Submittals.
- D. Manufacturers' field services.
- E. Fabricators' field services.

1.02 RELATED REQUIREMENTS

- A. Document 00 3100 - Available Project Information: Soil investigation data.
- B. Section 01 4000 - Quality Requirements.
- C. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.03 ABBREVIATIONS AND ACRONYMS

- A. AHJ: Authority having jurisdiction.
- B. NIST: National Institute of Standards and Technology.

1.04 DEFINITIONS

- A. Code or Building Code: ICC (IBC)-2015, Edition of the International Building Code and specifically, Chapter 17 - Special Inspections and Tests.
- B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. Special Inspection:
 - 1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved Contract Documents and the referenced standards.
 - 2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

1.05 REFERENCE STANDARDS

- A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
- B. AISC 360 - Specification for Structural Steel Buildings.
- C. ASTM A706 - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
- D. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- E. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
- F. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- G. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing.
- H. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops.
- I. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- J. AWS D1.1 - Structural Welding Code - Steel.
- K. AWS D1.3 - Structural Welding Code - Sheet Steel.
- L. AWS D1.4 - Structural Welding Code - Reinforcing Steel.
- M. IAS AC89 - Accreditation Criteria for Testing Laboratories.

- N. IAS AC291 - Accreditation Criteria for Special Inspection Agencies.
- O. ICC (IBC) - International Building Code.
- P. ICC (IBC)-2015 - International Building Code.
- Q. ICC (IBC)-2018 - International Building Code.
- R. SDI (QA/QC) - Standard for Quality Control and Quality Assurance for Installation of Steel Deck.
- S. SJI 100 - Catalog of Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders.
- T. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

1.06 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency is required to:
 - 1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Special Inspection Agency is acceptable to AHJ.
- C. Testing Agency Qualifications: Prior to the start of work, the Testing Agency is required to:
 - 1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Testing Agency is acceptable to AHJ.
- D. Manufacturer's Qualification Statement: Manufacturer is required to submit documentation of manufacturing capability and quality control procedures. Include documentation of AHJ approval.
- E. Fabricator's Qualification Statement: Fabricator is required to submit documentation of fabrication facilities and methods as well as quality control procedures. Include documentation of AHJ approval.
- F. Special Inspection Reports: After each special inspection, Special Inspector is required to promptly submit at least two copies of report; one to Architect and one to the AHJ.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.
 - d. Date and time of special inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of special inspection.
 - h. Date of special inspection.
 - i. Results of special inspection.
 - j. Compliance with Contract Documents.
 - 2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.
- G. Test Reports: After each test or inspection, promptly submit at least two copies of report; one to Architect and one to AHJ.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.

- c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test or inspection.
 - h. Date of test or inspection.
 - i. Results of test or inspection.
 - j. Compliance with Contract Documents.
- H. Certificates: When specified in individual special inspection requirements, Special Inspector shall submit certification by the manufacturer, fabricator, and installation subcontractor to Architect and AHJ, in quantities specified for Product Data.
- 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect and AHJ.
- I. Manufacturer's Field Reports: Submit reports to Architect and AHJ.
- 1. Submit report in duplicate within 30 days of observation to Architect for information.
 - 2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in Contract Documents.
- J. Fabricator's Field Reports: Submit reports to Architect and AHJ.
- 1. Submit report in duplicate within 30 days of observation to Architect for information.
 - 2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in Contract Documents.

1.07 SPECIAL INSPECTION AGENCY

- A. The Special Inspection Agency may employ and pay for services of an independent testing agency to perform testing and sampling associated with special inspections and required by the building code.
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.08 TESTING AND INSPECTION AGENCIES

- A. Owner or Architect may employ services of an independent testing agency to perform additional testing and sampling associated with special inspections but not required by the building code.
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.09 QUALITY ASSURANCE

- A. Special Inspection Agency Qualifications:
 - 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
 - 2. Accredited by IAS according to IAS AC291.
- B. Testing Agency Qualifications:
 - 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
 - 2. Accredited by IAS according to IAS AC89.
- C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

- A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
 - 1. Continuous Special Inspection: Special Inspection Agency is required to be present in the area where the work is being performed and observe the work at all times the work is in progress.
 - 2. Periodic Special Inspection: Special Inspection Agency is required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.
- B. Refer to drawings for "Statement of Special Inspections".

3.02 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION

- A. Structural Steel: Comply with quality assurance inspection requirements of ICC (IBC).
- B. Cold-Formed Steel Deck: Comply with quality assurance inspection requirements of SDI (QA/QC).
- C. Open-Web Joists and Joist Girders: Comply with requirements of ICC (IBC), Table 1705.2.3.
 - 1. End Connections - Welding or Bolted: Comply with requirements of SJI 100; periodic.
 - 2. Bridging - Horizontal or Diagonal:
 - a. Standard Bridging: Comply with requirements of SJI 100; periodic.
 - b. Bridging That Differs From the SJI Specifications: Periodic inspection.
- D. Welding:
 - 1. Structural Steel and Cold Formed Steel Deck:
 - a. Complete and Partial Joint Penetration Groove Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
 - b. Multi-pass Fillet Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
 - c. Single Pass Fillet Welds Less than 5/16 inch Wide: Verify compliance with AWS D1.1/D1.1M; periodic.
 - d. Plug and Slot Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
 - e. Single Pass Fillet Welds 5/16 inch or Greater: Verify compliance with AWS D1.1/D1.1M; continuous.
 - f. Floor and Roof Deck Welds: Verify compliance with AWS D1.3/D1.3M; continuous.
 - 2. Reinforcing Steel: Verify items listed below comply with AWS D1.4/D1.4M and ACI 318, Section 3.5.2.
 - a. Verification of weldability; periodic.
 - b. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames as well as boundary elements of special structural walls of concrete and shear reinforcement; continuous.
 - c. Shear reinforcement; continuous.
 - d. Other reinforcing steel; periodic.
- E. Steel Frame Joint Details: Verify compliance with approved Contract Documents.
 - 1. Details, bracing and stiffening; periodic.
 - 2. Member locations; periodic.
 - 3. Application of joint details at each connection; periodic.

3.03 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

- A. Reinforcing Steel, Including Prestressing of Tendons and Placement: Verify compliance with approved Contract Documents and ACI 318, Sections 3.5 and 7.1 through 7.7; periodic.
- B. Reinforcing Bar Welding: Verify compliance with AWS D1.4/D1.4M and ACI 318, 26.6.4; periodic.
 - 1. Verify weldability of reinforcing bars other than those complying with ASTM A706/A706M; periodic.
 - 2. Inspect single-pass fillet welds, maximum 5/16 inch; periodic.

3. Inspect all other welds; continuous.
- C. Anchors Cast in Concrete: Verify compliance with ACI 318, 17.8.2; periodic.
- D. Bolts Installed in Concrete: Where allowable loads have been increased or where strength design is used, verify compliance with approved Contract Documents and ACI 318, Sections 8.1.3 and 21.2.8 prior to and during placement of concrete; continuous.
- E. Anchors Post-Installed in Hardened Concrete: Verify compliance with ACI 318.
 1. Adhesive Anchors: Verify horizontally or upwardly-inclined orientation installations resisting sustained tension loads - Section 17.8.2.4; continuous.
 2. Other Mechanical and Adhesive Anchors: Verify as per Chapter 17.8.2; periodic.
- F. Design Mix: Verify plastic concrete complies with the design mix in approved Contract Documents and with ACI 318, Chapter 19, 16.4.3, 26.4.4; periodic.
- G. Design Mix: Verify plastic concrete complies with the design mix in approved Contract Documents and with ACI 318, Chapter 4 and 5.2; periodic.
- H. Concrete Sampling Concurrent with Strength Test Sampling: Each time fresh concrete is sampled for strength tests, verify compliance with ASTM C172, ASTM C31 and ACI 318, Chapter 26.5, 26.12, and record the following, continuous:
 1. Slump.
 2. Air content.
 3. Temperature of concrete.
- I. Concrete Placement: Verify application techniques comply with approved Contract Documents and ACI 318, Sections 5.9 and 5.10; continuous.
- J. Specified Curing Temperature and Techniques: Verify compliance with approved Contract Documents and ACI 318, Sections 5.11 through 5.13; periodic.
- K. Precast Concrete Members: Verify erection techniques and placement comply with approved Contract Documents and ACI 318, Chapter 16; periodic.
- L. Concrete Strength in Situ: Verify concrete strength complies with approved Contract Documents and ACI 318, Section 6.2, for the following.
 1. Prestressed members, prior to stressing of tendons; periodic.
 2. Beams and structural slabs, prior to removal of shores and forms; periodic.
- M. Formwork Shape, Location and Dimensions: Verify compliance with approved Contract Documents and ACI 318, Section 6.1.1; periodic.
- N. Welding of Reinforcing Bars: Conduct special inspections and verify Special Inspector's qualifications in accordance with requirements of AWS D1.4/D1.4M.

3.04 SPECIAL INSPECTIONS FOR SOILS

- A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
 1. Design bearing capacity of material below shallow foundations; periodic.
 2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
 3. Materials, densities, lift thicknesses; placement and compaction of backfill: continuous.
 4. Subgrade, prior to placement of compacted fill verify proper preparation; periodic.
- B. Testing: Classify and test excavated material; periodic.

3.05 SPECIAL INSPECTIONS FOR FIRE RESISTANT PENETRATIONS AND JOINTS

- A. Verify penetration firestops in accordance with ASTM E2174.
- B. Verify fire resistant joints in accordance with ASTM E2393.

3.06 OTHER SPECIAL INSPECTIONS

- A. Provide for special inspection of work that, in the opinion of the AHJ, is unusual in nature and where indicated on the contract documents

3.07 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

- A. Special Inspection Agency shall:
 - 1. Verify samples submitted by Contractor comply with the referenced standards and the approved Contract Documents.
 - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified reference standards.
 - 4. Ascertain compliance of materials and products with requirements of Contract Documents.
 - 5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
 - 6. Perform additional tests and inspections required by Architect.
 - 7. Submit reports of all tests or inspections specified.
- B. Limits on Special Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the work.
- C. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- D. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.08 MANUFACTURERS' AND FABRICATORS' FIELD SERVICES

- A. When specified in individual specification sections, require material suppliers, assembly fabricators, or product manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, to test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

END OF SECTION

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers.
- E. Vehicular access and parking.
- F. Waste removal facilities and services.
- G. Project identification sign.
- H. Field offices.

1.02 RELATED REQUIREMENTS

- A. Section 01 5100 - Temporary Utilities.
- B. Section 01 5213 - Field Offices and Sheds.
- C. Section 01 5500 - Vehicular Access and Parking.

1.03 TEMPORARY UTILITIES - SEE SECTION 01 5100

- A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

1.04 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
 - 1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
 - 2. Telephone Land Lines: One line, minimum; one handset per line.
 - 3. Internet Connections: Minimum of one; DSL modem or faster.
 - 4. Email: Account/address reserved for project use.

1.05 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

1.06 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition. Contractor is responsible for repair of all areas damaged by temporary construction.

1.07 VEHICULAR ACCESS AND PARKING - SEE SECTION 01 5500

1.08 WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.

- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

1.09 PROJECT IDENTIFICATION

- A. Provide project identification sign of design and construction indicated on drawings.
- B. Erect on site at location indicated.
- C. No other signs are allowed without Owner permission except those required by law.

1.10 FIELD OFFICES - SEE SECTION 01 5213

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5100
TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary Utilities: Provision of electricity, lighting, heat, ventilation, and water.

1.02 RELATED REQUIREMENTS

- A. Section 01 5000 - Temporary Facilities and Controls:

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards.

1.04 TEMPORARY ELECTRICITY

- A. Cost: By Contractor.
- B. Provide power service required from utility source.
- C. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor. Provide flexible power cords as required.
- D. Provide main service disconnect and over-current protection at convenient location and meter.
- E. Permanent convenience receptacles may be utilized during construction.
- F. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.05 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain LED, compact fluorescent, or high-intensity discharge lighting as suitable for the application for construction operations in accordance with requirements of 29 CFR 1926 and authorities having jurisdiction.
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- C. Maintain lighting and provide routine repairs.

1.06 TEMPORARY HEATING

- A. Cost of Energy: By Contractor.
- B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
- C. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

1.07 TEMPORARY WATER SERVICE

- A. Cost of Water Used: By Contractor.
- B. Provide and maintain suitable quality water service for construction operations at time of project mobilization.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5213
FIELD OFFICES AND SHEDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary field offices for use of Contractor.

1.02 RELATED REQUIREMENTS

- A. Section 01 5000 - Temporary Facilities and Controls:

PART 2 PRODUCTS

2.01 MATERIALS, EQUIPMENT, FURNISHINGS

- A. Materials, Equipment, Furnishings: Serviceable, new or used, adequate for required purpose.

2.02 CONSTRUCTION

- A. Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations, with steps and landings at entrance doors.
- B. Construction: Structurally sound, secure, weather tight enclosures for office. Maintain during progress of Work; remove when no longer needed.
- C. Fire Extinguishers: Appropriate type fire extinguisher at each office.

2.03 ENVIRONMENTAL CONTROL

- A. Heating, Cooling, and Ventilating: Automatic equipment to maintain comfort conditions.

2.04 CONTRACTOR OFFICE AND FACILITIES

- A. Size: For Contractor's needs and to provide space for project meetings.
- B. Telephone: As specified in Section 01 5000.
- C. Furnishings in Meeting Area: Conference table and chairs to seat at least eight persons; racks and files for Contract Documents, submittals, and project record documents.
- D. Other Furnishings: Contractor's option.
- E. Equipment: Six adjustable band protective helmets for visitors, one outdoor weather thermometer.

2.05 STORAGE SHEDS

- A. Prime subcontractors shall furnish storage facilities large enough to hold all materials that might be subject to damage or vandalism, that are required on the site at any one time. The facilities shall be adequately constructed so as to prevent damage from the elements and so they can be adequately secured. Location on the site shall be as per the Design-Builder's instructions. Each subcontractor shall bear the responsibility for the security of his own materials and equipment.

PART 3 EXECUTION

3.01 PREPARATION

- A. Fill and grade sites for temporary structures to provide drainage away from buildings.

3.02 INSTALLATION

- A. Install office spaces ready for occupancy 15 days after date fixed in Notice to Proceed.

3.03 MAINTENANCE AND CLEANING

- A. Maintain approach walks free of mud, water, and snow.

3.04 REMOVAL

- A. At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

END OF SECTION

SECTION 01 5500
VEHICULAR ACCESS AND PARKING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Access roads.
- B. Parking.
- C. Haul routes.
- D. Maintenance.
- E. Removal, repair.
- F. Mud from site vehicles.

PART 2 PRODUCTS

2.01 SIGNS, SIGNALS, AND DEVICES

- A. Stock Post Mounted and Wall Mounted Traffic Control and Informational Signs:

PART 3 EXECUTION

3.01 PREPARATION

- A. Clear areas, provide surface and storm drainage of road, parking, area premises, and adjacent areas.

3.02 ACCESS ROADS

- A. Construct new temporary all-weather access roads from public thoroughfares to serve construction area, of a width and load bearing capacity to provide unimpeded traffic for construction purposes.
- B. Extend and relocate as work progress requires, provide detours as necessary for unimpeded traffic flow.
- C. Provide unimpeded access for emergency vehicles. Maintain 20 foot width driveways with turning space between and around combustible materials.

3.03 PARKING

- A. Arrange for temporary parking areas to accommodate use of construction personnel.

3.04 HAUL ROUTES

- A. Confine construction traffic to designated haul routes.
- B. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

3.05 MAINTENANCE

- A. Maintain traffic and parking areas in a sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
- B. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

3.06 REMOVAL, REPAIR

- A. Remove temporary roads when permanent paving is usable.

- B. Remove underground work and compacted materials to a depth of 2 feet; fill and grade site as specified.
- C. Repair damage caused by installation.
- D. Remove post settings to a depth of 2 feet.

3.07 MUD FROM SITE VEHICLES

- A. Provide means of removing mud from vehicle wheels before entering streets.

END OF SECTION

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.

1.02 RELATED REQUIREMENTS

- A. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- B. Section 01 4000 - Quality Requirements: Product quality monitoring.

1.03 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. See Section 01 4000 - Quality Requirements, for additional source quality control requirements.
- C. Use of products having any of the following characteristics is not permitted:
 - 1. Made using or containing CFC's or HCFC's.
 - 2. Containing lead, cadmium, or asbestos.

2.02 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

- A. See Section 01 2500 - Substitution Procedures.

3.02 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.
- H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 7000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Cleaning and protection.
- C. Starting of systems and equipment.
- D. Demonstration and instruction of Owner personnel.
- E. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- F. General requirements for maintenance service.

1.02 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.04 QUALIFICATIONS

- A. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.05 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- C. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
- D. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work,

assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 LAYING OUT THE WORK

- A. The Contractor shall locate and provide all general reference points and take ordinary precautions to prevent their destruction. Each subcontractor shall be responsible for laying out his own work and shall be responsible for all lines, elevations measurements, grading and other as may be required by his work. He shall be held responsible for verifying all figures and details shown on the drawings, which relate to his work, prior to laying out the work. He will be held responsible for any error resulting from this failure to take such precautions.
- B. The Contractor shall be responsible for establishing field benchmarks for the purpose of establishing required elevations. The stakes shall be sufficiently far enough away from the work so as not to be disturbed.
- C. Verify locations of survey control points prior to starting work.
- D. Promptly notify Architect of any discrepancies discovered.
- E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- H. Utilize recognized engineering survey practices.
- I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations.
- J. Periodically verify layouts by same means.
- K. Maintain a complete and accurate log of control and survey work as it progresses.

3.04 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.05 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.06 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.07 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel in accordance with manufacturers' instructions.
- F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.08 DEMONSTRATION AND INSTRUCTION

- A. See Section 01 7900 - Demonstration and Training.
- B. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.
- C. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.

3.09 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.10 FINAL CLEANING

- A. Use cleaning materials that are nonhazardous.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.

- F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.11 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.12 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Individual Product Sections: Specific requirements for operation and maintenance data.
- C. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 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 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 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. Addenda.
 - 4. Change Orders and other modifications to the Contract.
- 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.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Changes made by Addenda and modifications.

- F. Record Drawings: Legibly mark each item to record actual construction including:
1. Field changes of dimension and detail.
 2. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 1. Description of unit or system, and component parts.
 2. Identify function, normal operating characteristics, and limiting conditions.
 3. Include performance curves, with engineering data and tests.
 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- E. Provide servicing and lubrication schedule, and list of lubricants required.
- F. Include manufacturer's printed operation and maintenance instructions.
- G. Include sequence of operation by controls manufacturer.
- H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- I. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 3 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrangement of Contents: Organize each volume in parts as follows:
 - 1. Project Directory.
 - 2. Table of Contents, of all volumes, and of this volume.
 - 3. Operation and Maintenance Data: Arranged by system, then by product category.
 - a. Source data.
 - b. Operation and maintenance data.
 - c. Field quality control data.
 - d. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
- F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- I. GUARANTEE PERIOD:
 - 1. The Contractor shall and hereby does guarantee and warrant that all work for this development, under this Contract, shall be free from defects or faulty labor and/or materials for a period of one (1) year from date of Substantial Completion of the project,

except when longer periods are herein specified, which develop within any guarantee periods.

END OF SECTION

Superseded General Decision Number: MI20240119

State: Michigan

Construction Type: Building

County: Gladwin 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).

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:	<ul style="list-style-type: none">. Executive Order 14026 generally applies to the contract.. The contractor must pay all covered workers at least \$17.75 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 2025.
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:	<ul style="list-style-type: none">. Executive Order 13658 generally applies to the contract.. The contractor must pay all covered workers at least \$13.30 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 2025.

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	01/03/2025
1	01/24/2025
2	04/11/2025

BOIL0169-002 01/01/2024

Rates

Fringes

BOILERMAKER.....\$ 39.65 35.68

BRMI0009-018 08/01/2024

	Rates	Fringes
BRICKLAYER.....	\$ 35.14	24.20
PLASTERER.....	\$ 33.09	26.58
TILE SETTER.....	\$ 31.43	21.13

CARP0706-008 06/01/2024

	Rates	Fringes
CARPENTER (Acoustical Ceiling Installation, Drywall Hanging, Form Work, and Metal Stud Installation).....	\$ 33.11	23.64

CARP0706-011 06/01/2024

	Rates	Fringes
CARPENTER (Excluding Acoustical Ceiling Installation, Drywall Hanging, Form Work, Metal Stud Installation, and Soft Floor Layer - Carpet).....	\$ 33.11	23.64

CARP1102-003 06/01/2024

	Rates	Fringes
MILLWRIGHT.....	\$ 36.47	40.52

ELEC0692-006 06/01/2024

	Rates	Fringes
ELECTRICIAN (Excludes Low Voltage Wiring).....	\$ 37.25	42.29%+10.18

ENGI0324-023 06/01/2022

	Rates	Fringes
OPERATOR: Power Equipment		
GROUP 1.....	\$ 44.13	24.85
GROUP 2.....	\$ 40.83	24.85
GROUP 3.....	\$ 38.18	24.85
GROUP 4.....	\$ 36.47	24.85
GROUP 5.....	\$ 30.61	24.85
GROUP 6.....	\$ 26.38	24.85

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 and whirley derrick
GROUP 3: Crane; Loader; Paver; Scraper; Stiff Leg Derrick

GROUP 4: Bobcat/Skid Loader; Fork Truck (over 20' lift)
GROUP 5: Fork Truck (20' lift and under for masonry work)
GROUP 6: Oiler

* IRON0025-009 04/01/2024

	Rates	Fringes
IRONWORKER, STRUCTURAL (Metal Building Erection Only).....	\$ 26.59	26.53

IRON0025-010 06/01/2024

	Rates	Fringes
IRONWORKER, REINFORCING.....	\$ 33.43	37.15
IRONWORKER, STRUCTURAL.....	\$ 35.55	35.83

LAB01098-029 07/01/2024

	Rates	Fringes
LABORER		
Mason Tender - Brick;		
Mason Tender -		
Cement/Concrete; and		
Pipelayer.....	\$ 26.20	13.45
Sandblaster.....	\$ 27.44	13.45

PAIN1803-001 06/01/2024

	Rates	Fringes
PAINTER: Brush, Roller and Spray.....	\$ 27.78	19.05
PAINTER: Drywall Finishing/Taping.....	\$ 28.77	21.77

PLAS0016-038 04/01/2014

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 25.47	12.38

PLUM0085-004 05/01/2024

	Rates	Fringes
PIPEFITTER (Excludes HVAC Pipe and System Installation)....	\$ 45.50	21.75
PIPEFITTER (HVAC Pipe Installation Only).....	\$ 45.50	21.75
PLUMBER (Excluding HVAC Pipe and System Installation).....	\$ 43.50	22.10

SHEE0007-021 05/01/2018

	Rates	Fringes
SHEET METAL WORKER (Excluding HVAC Duct & System Installation).....	\$ 26.83	23.78
SHEET METAL WORKER (HVAC Duct & System Installation).....	\$ 26.83	23.78

* SUMI2011-044 02/14/2011

	Rates	Fringes
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ASBESTOS WORKER/HEAT & FROST INSULATOR.....	\$ 19.82	7.31
CARPENTER (Floor Laying-Carpet Only).....	\$ 19.59	7.57
GLAZIER.....	\$ 16.95 **	4.74
LABORER: Common or General.....	\$ 11.75 **	1.22
LABORER: Landscape & Irrigation.....	\$ 12.84 **	0.00
OPERATOR: Backhoe/Excavator.....	\$ 19.00	1.22
OPERATOR: Bulldozer.....	\$ 22.34	1.22
OPERATOR: Grader/Blade.....	\$ 24.04	6.03
OPERATOR: Roller.....	\$ 28.02	7.07
OPERATOR: Tractor.....	\$ 19.60	7.31
ROOFER.....	\$ 15.73 **	7.41
SPRINKLER FITTER (Fire Sprinklers).....	\$ 19.36	4.53
TRUCK DRIVER, Includes Dump and Tandem Truck.....	\$ 15.65 **	3.12
TRUCK DRIVER: Flatbed Truck.....	\$ 16.80 **	3.97

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 (\$17.75) or 13658 (\$13.30). 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

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate 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. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the 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. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the

discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were 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. The date, 01/03/2024 in the example, 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:

- a) a survey underlying a wage determination
- b) an existing published wage determination
- c) an initial WHD letter setting forth a position on a wage determination matter
- d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail 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 an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail 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 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.

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END OF GENERAL DECISION"

METHOD OF PROCUREMENT DECISION MATRIX

(To be used for all procurements except micropurchases)

As required by Federal Transit Administration Circular FTA C 4220.1F Third-Party Contracting Guidance, Revision 4, March 18, 2013, and all subsequent editions, as available on FTA's website, www.fta.dot.gov.

AGENCY

ITEMS BEING PROCURED	PROJECT AUTHORIZATION
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REQUEST FOR QUOTES (RFQ) a.k.a small purchase

Amount < \$250,000

Multiple sources

Price is the only determining factor in award

SEALED BID (IFB)

Any dollar amount

Multiple sources

Complete and adequate specifications or description

Selection can be made on basis of price alone

Suitable for firm, fixed price

No discussion with bidders needed after receipt of offers

COMPETITIVE PROPOSALS (RFP)

Any dollar amount

Multiple sources

Selection based on price and other criteria

Discussion with proposers allowed after receipt of offers

Fixed price can be set after discussion

ARCHITECTURAL AND ENGINEERING (QUALIFICATION BASED)

Multiple sources

A & E services that lead to construction

SOLE SOURCE

Custom item

Only one source

Public urgency/emergency

Competition is inadequate after public solicitation

MDOT approval

STATE EXTENDED CONTRACT/PIGGYBACK PURCHASE

--

SIGNATURE

DATE

CERTIFICATION OF COMPLIANCE WITH FEDERAL CONTRACT CLAUSES

As required by Federal Transit Administration Circular FTA C 4220.1F Third-Party Contracting Guidance, Revision 4, March 18, 2013, and all subsequent editions, as available on FTA's website, www.fta.dot.gov.

To be used for all procurements over \$10,000 if the federal contract clauses are not included in a third-party contract. Not required for Requests for Quotes (a.k.a. small purchases) for items purchased off-the-shelf.* Third-party contracts are required for procurements of \$100,000 or more.

acknowledges receipt of the **attached** contract clauses and

(Vendor Name)

certifies compliance with all federal requirements for

(Product Description)

being purchased by

(Transit Agency)

under project authorization

(Authorization Number)

VENDOR REPRESENTATIVE	TITLE	
SIGNATURE (Vendor representative)		DATE

* "Off-the-shelf item" means an item produced and placed in stock by a contractor, or stocked by a distributor, before receiving orders or contracts for its sale, Federal Acquisition Regulation (FAR) 46.1-1, issued March 2005. Payment request letters should say when items are procured off-the-shelf. Suggested language is "These tires are off-the-shelf items purchased from Company A Tire who had the tires in stock." or "These tires are off-the-shelf items purchased from Company A Tire, who obtained them from Company B Wholesaling, who had the tires in stock."

INDEPENDENT COST ESTIMATE

(To be used for all procurements of more than \$100,000 except the purchase of revenue vehicles off state contracts where an Independent Cost Estimate is only required for purchases of more than \$250,000)
Need one form for each item being procured.

As required by Federal Transit Administration Circular FTA C 4220.1F Third Party Contracting Guidance, Rev. 4, March 18, 2013, and all subsequent editions, as available on FTA's website, www.fta.dot.gov.

AGENCY _____

PROJECT AUTHORIZATION	ITEM BEING PROCURED	COST ESTIMATE
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Estimate was obtained using the following process:

- ☐ Published price list (e.g., catalogs).
- ☐ Past pricing. Previous purchase date for similar item: _____
- ☐ Engineering or technical estimate.
- ☐ Item is a standard commercial item sold in the open marketplace.
- ☐ Analysis of price components against current published standards, such as labor rate, cost per unit, etc.
- ☐ For buses only, State of Michigan order form or State Vehicle Purchasing Program
- ☐ Other (please describe) _____

SIGNATURE _____

DATE _____

PRICE ANALYSIS

Use for all procurements of \$50,000 or more, unless a cost analysis is required.

As required by Federal Transit Administration Circular FTA C 4220.1F Third-Party Contracting Guidance, Revision 4, March 18, 2013, and all subsequent editions, as available on FTA's website, www.fta.dot.gov.

AGENCY

ITEM BEING PROCURED

PROJECT AUTHORIZATION

A price analysis is needed to determine if the offers you received are fair and reasonable. The most common way to make this determination is to compare the offers to your Independent Cost Estimate (ICE). You may need to conduct additional analysis if your ICE is not consistent with the offers received. An ICE is only required for procurements of more than \$100,000 or more than \$250,000 when buying off state bus contracts. Leave the INDEPENDENT COST ESTIMATE field blank if your procurement does not require an ICE.

Step 1: Determine if the offered prices are Fair and Reasonable by comparing them to your ICE, if one was required.

INDEPENDENT COST ESTIMATE	VENDOR A OFFERED PRICE	VENDOR B OFFERED PRICE	VENDOR C OFFERED PRICE	VENDOR D OFFERED PRICE

(Attach additional sheets if more than four vendors submitted prices)

For Request For Proposal (RFP) procurements and procurements of A & E services, if an ICE was required and it is consistent with the offered prices, proceed to Step 3. If not, complete Step 2 and Step 3. Sign and date this form and submit it with your procurement documents.

For Invitation for Bid (IFB) procurements and Request For Quotes (RFQ) procurements, if an ICE was required and it is consistent with the offered prices, sign and date this form and submit with your procurement documents. If not, complete Step 2. Sign and date this form and submit with your procurement documents.

Step 2: Determine if offer is fair and reasonable (complete either a or b below).

a. Explain how the above numbers show that the price is fair and reasonable:

b. If you cannot use your ICE to determine if the price is fair and reasonable, additional explanation is required. Please indicate how you determined the price is fair and reasonable. Some accepted forms of price analysis techniques discussed in the Pricing Guide for FTA Grantees are:

1. Prices set by law or regulation (e.g., utility rates)
2. Established catalog prices
3. Comparison to previous purchases
4. Current published standards
5. Established market prices

Please indicate your technique. Retain supporting documentation in your files and make available to MDOT upon request.

Prices are set by law or regulation. These are considered fair and reasonable. Grantees should acquire a copy of the rate schedules set by the applicable law or regulation. Once these schedules are obtained, verify they apply to your situation, and you are being charged the correct price. For utility contracts, this policy applies only to prices prescribed by an effective, independent, regulatory body.

Comparison with competing suppliers' prices or catalog pricing for the same item. (Documentation could be copies of the catalog pages, website screenshots, etc). Established catalog prices require the following conditions:

- Established catalog prices exist
- The items are commercial in nature
- They are sold in substantial quantities
- They are sold to the general public

Comparison of proposed pricing with historical pricing from previous purchases of the same item. Changes in quantity, quality, delivery schedules, the economy, and inclusion of non-recurring costs such as design, capital equipment, etc., can cause price variations. Each situation must be analyzed. Also ensure that the previous price was fair and reasonable. Documentation should be a copy of the previous purchase invoices or quotes.

A written analysis of price components against current published standards, such as labor rates, dollars per pound, etc., to justify the price reasonableness of the whole.

Established market prices are based on the same principle as catalog prices except there is no catalog. A market price is a current price established in the usual or ordinary course of business between buyers and sellers free to bargain. These prices must be verified by buyers and sellers who are independent of the offeror. If you cannot determine other commercial buyers and sellers, you may obtain this information from the offeror. Documentation could be advertisements, catalog pages or invoices from other buyers and sellers.

Other (provide explanation):

Step 3: Negotiation – Required for A & E procurements and may be appropriate for some RFP procurements.

For RFP procurements – were negotiations conducted with the selected vendor?

☐ Yes ☐ No, If No, why not?

For all A & E and those RFP procurements that conducted negotiations, describe the negotiations that occurred.

NAME

SIGNATURE

TITLE

DATE

RESPONSIBILITY DETERMINATION
(To be used for procurements utilizing an IFB or RFP)

As required by Federal Transit Administration Circular FTA C 4220.1F Third Party Contracting Guidance, Rev. 4, March 18, 2013, and all subsequent editions, as available on FTA's website, www.fta.dot.gov.

AGENCY

ITEM BEING PROCURED

PROJECT AUTHORIZATION NO.

SUPPLIER

Bid Received on time	<input type="checkbox"/> Yes <input type="checkbox"/> No	Price in separate sealed envelope	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Clauses signed	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Bid Security Received	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A

For each of the areas described below, check that the appropriate research has been accomplished. Explain how you did the research and the rationale for your determination.

1. Appropriate financial, equipment, facility, and personnel: Does the vendor have the expertise, equipment, etc. to fulfill the order and comply with the contract?

☐ Acceptable ☐ Not acceptable

Comments:

2. Ability to meet the delivery schedule

☐ Acceptable ☐ Not acceptable

Comments:

3. Satisfactory period of performance: Has the vendor demonstrated ability to do this type of job in the past?

☐ Acceptable ☐ Not acceptable

Comments:

4. Satisfactory record of integrity, not on debarred or suspended listings (<https://www.sam.gov/SAM>) Attach a copy of the debarment documentation.

☐ Acceptable ☐ Not acceptable

Comments:

5. Receipt of all necessary data from supplier: Did vendor submit all requested information?

☐ Acceptable ☐ Not acceptable

Comments:

SIGNATURE

DATE

ADVERTISEMENT AND SOLICITATION

(To be used for procurements utilizing an IFB or RFP)

As required by Federal Transit Administration Circular FTA C 4220.1F Third Party Contracting Guidance, Rev. 4, March 18, 2013, and all subsequent editions, as available on FTA's website, www.fta.dot.gov.

AGENCY

ITEM BEING PROCURED

PROJECT AUTHORIZATION NO.

COMPANIES TO BE NOTIFIED **

PROCUREMENT TO BE PUBLISHED* (Newspaper, trade magazine, website, etc)

** Retain copies of communications with companies e-mails, letters, etc. in your procurement file.

* Retain copies of published ads, screenshots of publication on websites, etc. in your procurement file.

NAME

TITLE

SIGNATURE

DATE

BID OPENING

(To be used for procurements utilizing an IFB)

As required by Federal Transit Administration Circular FTA C 4220.1F Third Party Contracting Guidance, Rev. 4, March 18, 2013, and all subsequent editions, as available on FTA's website, www.fta.dot.gov.

AGENCY

ITEM BEING PROCURED

PROJECT AUTHORIZATION

BID DUE DATE AND TIME

BID OPENING DATE AND TIME

LOCATION OF OPENING

BID OPENING ATTENDEES (Use this form or attach sign-in sheet):

PRINTED NAME	COMPANY	SIGNATURE

NAME OF BIDDER/COMPANY	TIME AND DATE BID RECEIVED AT AGENCY	BID AMOUNT

LOWEST BID

COMPANY	BID AMOUNT
TRANSIT AGENCY REPRESENTATIVE	TITLE

I certify this firm has met all solicitation specifications and conditions.

SIGNATURE	DATE
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SIGNATURE	DATE
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SCORE SHEET *

Each evaluator must complete an evaluation for each proposal received.

EVALUATOR

VENDOR A:

EVALUATION CRITERIA (as listed in RFP)	SCORE
TOTAL POINTS	

VENDOR B:

EVALUATION CRITERIA (as listed in RFP)	SCORE
TOTAL POINTS	

VENDOR C:

EVALUATION CRITERIA (as listed in RFP)	SCORE
TOTAL POINTS	

* Transit agencies are allowed to use score sheets of a locally created format and design.

Attachment number or letter

CONSTRUCTION MORE THAN \$150,000

LOBBYING

Applicability – construction/architectural and engineering/acquisition of rolling stock/professional service contract/operational service contract/turnkey contracts over \$150,000.

Byrd Anti-Lobbying Amendment, 31 U.S.C. 1352, as amended by the Lobbying Disclosure Act of 1995, P.L. 104- 65 [to be codified at 2 U.S.C. § 1601, et seq.] - Contractors who apply or bid for an award of \$150,000 or more shall file the certification required by 49 CFR part 20, "New Restrictions on Lobbying." 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 the name of any registrant under the Lobbying Disclosure Act of 1995 who has made lobbying contacts on its behalf with non-Federal funds with respect to that Federal contract, grant or award covered by 31 U.S.C. 1352. Such disclosures are forwarded from tier to tier up to the recipient.

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 31 U.S.C. § 1352 (as amended by the Lobbying Disclosure Act of 1995). 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.

CONTRACTOR / COMPANY NAME

NAME, TITLE AND SIGNATURE OF CONTRACTOR'S AUTHORIZED OFFICIAL:

TYPE OR PRINT NAME	TITLE	
SIGNATURE		DATE

BUY AMERICA CERTIFICATION (STEEL AND MANUFACTURED PRODUCTS)

Applicability – construction contracts and acquisition of goods or rolling stock (valued at more than \$150,000).

Contractor shall comply with 49 USC 5323(j) and 49 CFR 661, as amended by MAP-21 stating that Federal funds may not be obligated unless steel, iron and manufactured products used in FTA-funded projects are produced in the United States, unless a waiver has been granted by FTA or the product is subject to a general waiver. General waivers are listed in 49 CFR 661.7, and include software, microcomputer equipment and small purchases (currently less than \$150,000) made with capital, operating or planning funds. A bidder or offeror shall submit appropriate Buy America certification to the recipient with all bids on FTA-funded contracts, except those subject to a general waiver. Proposals not accompanied by a completed Buy America certification shall be rejected as nonresponsive. This requirement does not apply to lower tier subcontractors.

Certificate of **Compliance** with Buy America Requirements.

The bidder or offeror hereby certifies that it will comply with the requirements of 49 U.S.C. 5323(j)(1), and the applicable regulations in 49 CFR part 661.

CONTRACTOR / COMPANY NAME

NAME, TITLE AND SIGNATURE OF CONTRACTOR'S AUTHORIZED OFFICIAL:

TYPE OR PRINT NAME	TITLE	
SIGNATURE		DATE

Only sign either Certificate of **Compliance** or Certificate of **Non-Compliance**

Certificate of **Non-Compliance** with Buy America Steel or Manufactured Products Requirements The bidder or offeror hereby certifies that it cannot comply with the requirements of 49 U.S.C. 5323(j), but it may qualify for an exception to the requirement pursuant to 49 U.S.C. 5323(j)(2), as amended, and the applicable regulations in 49 C.F.R. 661.7.

CONTRACTOR / COMPANY NAME

NAME, TITLE AND SIGNATURE OF CONTRACTOR'S AUTHORIZED OFFICIAL:

TYPE OR PRINT NAME	TITLE	
SIGNATURE		DATE

GOVERNMENT WIDE DEBARMENT AND SUSPENSION (NON PROCUREMENT)

Applicability – all contracts more than \$25,000.

The Recipient agrees to the following:

1. It will comply with the requirements of 2 C.F.R. part 180, subpart C, as adopted and supplemented by U.S. DOT regulations at 2 C.F.R. part 1200, which include the following: (a) It will not enter into any arrangement to participate in the development or implementation of the Project with any Third Party Participant that is debarred or suspended except as authorized by: 1 U.S. DOT regulations, "Nonprocurement Suspension and Debarment," 2 C.F.R. part 1200, 2 U.S. OMB, "Guidelines to Agencies on Governmentwide Debarment and Suspension (Nonprocurement)," 2 C.F.R. part 180, including any amendments thereto, and 3 Executive Orders Nos. 12549 and 12689, "Debarment and Suspension," 31 U.S.C. § 6101 note, (b) It will review the U.S. GSA "System for Award Management," <http://www.sam.gov.proxy1.semalt.design> if required by U.S. DOT regulations, 2 C.F.R. part 1200, and (c) It will include, and require each of its Third Party Participants to include, a similar provision in each lower tier covered transaction, ensuring that each lower tier Third Party Participant: 1 Will comply with Federal debarment and suspension requirements, and 2 Reviews the "System for Award Management" at <http://www.sam.gov.proxy1.semalt.design> if necessary to comply with U.S. DOT regulations, 2 C.F.R. part 1200.

Construction More Than \$150,000

2. If the Recipient suspends, debars, or takes any similar action against a Third Party Participant or individual, the Recipient will provide immediate written notice to the: (a) FTA Regional Counsel for the Region in which the Recipient is located or implements the Project, (b) FTA Project Manager if the Project is administered by an FTA Headquarters Office, or (c) FTA Chief Counsel.

CONTRACTOR / COMPANY NAME

NAME, TITLE AND SIGNATURE OF CONTRACTOR'S AUTHORIZED OFFICIAL:

TYPE OR PRINT NAME	TITLE
SIGNATURE	DATE

SEISMIC SAFETY

Construction of new buildings or additions to existing buildings. These requirements do not apply to micropurchases (\$10,000 or less, except for construction contracts of more than \$2,000).

Contractor agrees that any new building or addition to an existing building shall be designed and constructed in accordance with the standards required in USDOT Seismic Safety Regulations 49 CFR 41 and shall certify compliance to the extent required by the regulation. Contractor shall also ensure that all work performed under this contract, including work performed by subcontractors, complies with the standards required by 49 CFR 41 and the certification of compliance issued on the project.

BONDING REQUIREMENTS

Applicability – for those construction or facility improvement contracts or subcontracts exceeding \$150,000, FTA may accept the bonding policy and requirements of the recipient, provided that they meet the minimum requirements for construction contracts as follows:

1. A bid guarantee from each bidder equivalent to five (5) percent of the bid price. The "bid guarantees" shall consist of a firm commitment such as a bid bond, certified check, or other negotiable instrument accompanying a bid as assurance that the bidder will, upon acceptance of his bid, execute such contractual documents as may be required within the time specified.
2. A performance bond on the part to the Contractor for 100 percent of the contract price. A "performance bond" is one executed in connection with a contract to secure fulfillment of all the contractor's obligations under such contract.
3. A payment bond on the part of the contractor for 100 percent of the contract price. A "payment bond" is one executed in connection with a contract to assure payment, as required by law, of all persons supplying labor and material in the execution of the work provided for in the contract. FTA, however, has determined that payment bonds in the following amounts are adequate to protect FTA's interest and will accept a local bonding policy that meets the following minimums:
 - a. 50% of the contract price if the contract price is not more than \$1 million;
 - b. 40% of the contract price if the contract price is more than \$1 million but not more than \$5 million; or
 - c. \$2.5 million if the contract price is more than \$5 million.
4. A cash deposit, certified check or other negotiable instrument may be accepted by a grantee in lieu of performance and payment bonds, provided the grantee has established a procedure to assure that the interest of FTA is adequately protected. An irrevocable letter of credit would also satisfy the requirement for a bond.

Bid Bond Requirements (Construction):

- a. Bid Security - A Bid Bond must be issued by a fully qualified surety company acceptable to (Recipient) and listed as a company currently authorized under 31 CFR, Part 223 as possessing a Certificate of Authority as described thereunder.

- b. Rights Reserved - In submitting this Bid, it is understood and agreed by bidder that the right is reserved by (Recipient) to reject any and all bids, or part of any bid, and it is agreed that the Bid may not be withdrawn for a period of [ninety (90)] days subsequent to the opening of bids, without the written consent of (Recipient). It is also understood and agreed that if the undersigned bidder should withdraw any part or all of his bid within [ninety (90)] days after the bid opening without the written consent of (Recipient), shall refuse or be unable to enter into this Contract, as provided above, or refuse or be unable to furnish adequate and acceptable Performance Bonds and Labor and Material Payments Bonds, as provided above, or refuse or be unable to furnish adequate and acceptable insurance, as provided above, he shall forfeit his bid security to the extent of (Recipient's) damages occasioned by such withdrawal, or refusal, or inability to enter into an agreement, or provide adequate security therefor. It is further understood and agreed that to the extent the defaulting bidder's Bid Bond, Certified Check, Cashier's Check, Treasurer's Check, and/or Official Bank Check (excluding any income generated thereby which has been retained by (Recipient) as provided in [Item x "Bid Security" of the Instructions to Bidders]) shall prove inadequate to fully recompense (Recipient) for the damages occasioned by default, then the undersigned bidder agrees to indemnify (Recipient) and pay over to (Recipient) the difference between the bid security and (Recipient's) total damages, so as to make (Recipient) whole. The undersigned understands that any material alteration of any of the above or any of the material contained on this form, other than that requested, will render the bid unresponsive.

Performance and Payment Bonding Requirements (Construction)

The Contractor shall be required to obtain performance and payment bonds as follows:

- a. Performance bonds
 1. The penal amount of performance bonds shall be 100 percent of the original contract price, unless the (Recipient) determines that a lesser amount would be adequate for the protection of the (Recipient).
 2. The (Recipient) may require additional performance bond protection when a contract price is increased. The increase in protection shall generally equal 100 percent of the increase in contract price. The (Recipient) may secure additional protection by directing the Contractor to increase the penal amount of the existing bond or to obtain an additional bond.
- b. Payment bonds
 1. The penal amount of the payment bonds shall equal:
 - I. Fifty percent of the contract price if the contract price is not more than \$1 million.
 - II. Forty percent of the contract price if the contract price is more than \$1 million but not more than \$5 million; or
 - III. Two and one half million if the contract price is more than \$5 million.
 2. If the original contract price is \$5 million or less, the (Recipient) may require additional protection as required by subparagraph 1 if the contract price is increased.

Performance and Payment Bonding Requirements (Non-Construction)

The Contractor may be required to obtain performance and payment bonds when necessary to protect the (Recipient's) interest.

- a. The following situations may warrant a performance bond:
 1. (Recipient) property or funds are to be provided to the contractor for use in performing the contract or as partial compensation (as in retention of salvaged material).
 2. A contractor sells assets to or merges with another concern, and the (Recipient), after recognizing the latter concern as the successor in interest, desires assurance that it is financially capable.
 3. Substantial progress payments are made before delivery of end items starts.
 4. Contracts are for dismantling, demolition, or removal of improvements.
- b. When it is determined that a performance bond is required, the Contractor shall be required to obtain performance bonds as follows:
 1. The penal amount of performance bonds shall be 100 percent of the original contract price, unless the (Recipient) determines that a lesser amount would be adequate for the protection of the (Recipient).

2. The (Recipient) may require additional performance bond protection when a contract price is increased. The increase in protection shall generally equal 100 percent of the increase in contract price. The (Recipient) may secure additional protection by directing the Contractor to increase the penal amount of the existing bond or to obtain an additional bond.
- c. A payment bond is required only when a performance bond is required, and if the use of payment bond is in the (Recipient's) interest.
- d. When it is determined that a payment bond is required, the Contractor shall be required to obtain payment bonds as follows:
 1. The penal amount of payment bonds shall equal:
 - I. Fifty percent of the contract price if the contract price is not more than \$1 million;
 - II. Forty percent of the contract price if the contract price is more than \$1 million but not more than \$5 million; or
 - III. Two and one half million if the contract price is increased.

Advance Payment Bonding Requirements

The Contractor may be required to obtain an advance payment bond if the contract contains an advance payment provision and a performance bond is not furnished. The (recipient) shall determine the amount of the advance payment bond necessary to protect the (Recipient).

Patent Infringement Bonding Requirements (Patent Indemnity)

The Contractor may be required to obtain a patent indemnity bond if a performance bond is not furnished and the financial responsibility of the Contractor is unknown or doubtful. The (recipient) shall determine the amount of the patent indemnity to protect the (Recipient).

Warranty of the Work and Maintenance Bonds:

1. The Contractor warrants to (Recipient), the Architect and/or Engineer that all materials and equipment furnished under this Contract will be of highest quality and new unless otherwise specified by (Recipient), free from faults and defects and in conformance with the Contract Documents. All work not so conforming to these standards shall be considered defective. If required by the [Project Manager], the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.
2. The Work furnished must be of first quality and the workmanship must be the best obtainable in the various trades. The Work must be of safe, substantial and durable construction in all respects. The Contractor hereby guarantees the Work against defective materials or faulty workmanship for a minimum period of one (1) year after Final Payment by (Recipient) and shall replace or repair any defective materials or equipment or faulty workmanship during the period of the guarantee at no cost to (Recipient). As additional security for these guarantees, the Contractor shall, prior to the release of Final Payment [as provided in Item X below], furnish separate Maintenance (or Guarantee) Bonds in form acceptable to (Recipient) written by the same corporate surety that provides the Performance Bond and Labor and Material Payment Bond for this Contract. These bonds shall secure the Contractor's obligation to replace or repair defective materials and faulty workmanship for a minimum period of one (1) year after Final Payment and shall be written in an amount equal to ONE HUNDRED PERCENT (100%) of the CONTRACT SUM, as adjusted (if at all).

DAVIS-BACON AND COPELAND ANTI-KICKBACK ACTS

Applicability – construction contracts and subcontracts, including actual construction, alteration and/or repair, including decorating and painting, of more than \$2,000.

1. Minimum wages - (i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the

Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR Part 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein. Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met: (1) Except with respect to helpers as defined as 29 CFR 5.2(n)(4), the work to be performed by the classification requested is not performed by a classification in the wage determination; and (2) The classification is utilized in the area by the construction industry; and (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination; and (4) With respect to helpers as defined in 29 CFR 5.2(n)(4), such a classification prevails in the area in which the work is performed. (B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary. (C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary. (D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii) (B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification. (iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof. (iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program. (v)(A) The contracting officer shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall

be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefor only when the following criteria have been met: (1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and (2) The classification is utilized in the area by the construction industry; and (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination. (B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary. (C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary. (D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(v) (B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

2. Withholding - The recipient 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 the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, the grantee may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.
3. Payrolls and basic records - (i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs. (ii)(A) The contractor shall submit weekly for each week in which any contract work is performed a copy of all

payrolls to the recipient for transmission to the Federal Transit Administration. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under section 5.5(a)(3)(i) of Regulations, 29 CFR part 5. This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal Stock Number 029-005-00014-1), U.S. Government Printing Office, and Washington, DC 20402. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. (B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following: (1) That the payroll for the payroll period contains the information required to be maintained under section 5.5(a)(3)(i) of Regulations, 29 CFR part 5 and that such information is correct and complete; (2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3; (3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract. (C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section. (D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code. (iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the Federal Transit Administration or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and trainees - (i) Apprentices - Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification.

If the Administrator of the Wage and Hour Division of the U.S. Department of Labor determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved. (ii) Trainees - Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved. (iii) Equal employment opportunity - The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

5. Compliance with Copeland Act requirements - The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.
6. Subcontracts - The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the Federal Transit Administration 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 the contract clauses in 29 CFR 5.5.
7. Contract termination; debarment - A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.
8. Compliance with Davis-Bacon and Related Act requirements - All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.
9. Disputes concerning labor standards - Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.
10. Certification of Eligibility - (i) By entering into this contract, contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1). (ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1). (iii) The penalty for making false statements is prescribed in 18 USC 1001.

CONTRACT WORK HOURS & SAFETY STANDARDS ACT

Applicability – contracts of more than \$150,000.

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 40 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 40 hours in such workweek.
2. Violation; liability for unpaid wages; liquidated damages - In the event of any violation of the clause set forth in para. (1) of this section, contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable 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 para. (1) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages required by the clause set forth in para. (1) of this section.
3. Withholding for unpaid wages and liquidated damages - the recipient shall upon its own action or upon written request of USDOL withhold or cause to be withheld, from any moneys payable on account of work performed by 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 & 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 para. (2) of this section.
4. Subcontracts - Contractor or subcontractor shall insert in any subcontracts the clauses set forth in this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. Prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in this section.

BREACHES AND DISPUTE RESOLUTION

Applicability – all contracts more than \$150,000.

Disputes arising in the performance of this contract which are not resolved by agreement of the parties shall be decided in writing by the recipient's authorized representative. This decision shall be final and conclusive unless within ten (10) days from the date of receipt of its copy, contractor mails or otherwise furnishes a written appeal to the recipient's CEO. In connection with such appeal, contractor shall be afforded an opportunity to be heard and to offer evidence in support of its position. The decision of the recipient's CEO shall be binding upon contractor and contractor shall abide by the decision. FTA has a vested interest in the settlement of any violation of Federal law including the False Claims Act, 31 U.S.C. § 3729. Performance During Dispute - Unless otherwise directed by the recipient, contractor shall continue performance under this contract while matters in dispute are being resolved. Claims for Damages - Should either party to the contract suffer injury or damage to person or property because of any act or omission of the party or of any of his employees, agents or others for whose acts he is legally liable, a claim for damages therefore shall be made in writing to such other party within ten days after the first observance of such injury or damage. Remedies - Unless this contract provides otherwise, all claims, counterclaims, disputes and other matters in question between the recipient and contractor arising out of or relating to this agreement or its breach will be decided by arbitration if the parties mutually agree, or in a court of competent jurisdiction within the residing State. Rights and Remedies - Duties and obligations imposed by the contract documents and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law. No action or failure to act by the recipient or contractor shall constitute a waiver of any right or duty afforded any of them under the contract, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

CLEAN AIR

Applicability – all contracts more than \$150,000.

1. Contractor shall comply with all applicable standards, orders or regulations pursuant to the Clean Air Act, 42 USC 7401 et seq. Contractor shall report each violation to the recipient and understands and agrees that the recipient will, in turn, report each violation as required to FTA and the appropriate EPA Regional Office.
2. Contractor shall include these requirements in each subcontract exceeding \$150,000 financed in whole or in part with FTA assistance.

CLEAN WATER

Applicability – all contracts and Subcontracts more than \$150,000. Contractor shall comply with all applicable standards, orders or regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 USC 1251 et seq. Contractor shall report each violation to the recipient and understands and agrees that the recipient shall, in turn, report each violation as required to FTA and the appropriate EPA Regional Office. Contractor shall include these requirements in each subcontract exceeding \$100,000 financed in whole or in part with FTA assistance.

FLY AMERICA REQUIREMENTS

Applicability – all contracts involving transportation of persons or property, by air between the U.S. and/or places outside the U.S. These requirements do not apply to micro-purchases (\$10,000 or less, except for construction contracts over \$2,000).

Contractor shall comply with 49 USC 40118 (the “Fly America” Act) in accordance with General Services Administration regulations 41 CFR 301-10, stating that recipients and subrecipients of Federal funds and their contractors are required to use US Flag air carriers for US Government-financed international air travel and transportation of their personal effects or property, to the extent such service is available, unless travel by foreign air carrier is a matter of necessity, as defined by the Fly America Act. Contractor shall submit, if a foreign air carrier was used, an appropriate certification or memorandum adequately explaining why service by a US flag air carrier was not available or why it was necessary to use a foreign air carrier and shall, in any event, provide a certificate of compliance with the Fly America requirements. Contractor shall include the requirements of this section in all subcontracts that may involve international air transportation.

CARGO PREFERENCE

Applicability – all contracts involving equipment, materials or commodities which may be transported by ocean vessels. These requirements do not apply to micro-purchases (\$10,000 or less, except for construction contracts over \$2,000).

Contractor shall: a. use privately owned US-Flag commercial vessels to ship at least 50% of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners and tankers) involved, whenever shipping any equipment, material or commodities pursuant to the underlying contract to the extent such vessels are available at fair and reasonable rates for US flag commercial vessels; b. furnish within 20 working days following the loading date of shipments originating within the US or within 30 working days following the loading date of shipments originating outside the US, a legible copy of a rated, “on-board” commercial bill-of-lading in English for each shipment of cargo described herein to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590 and to the recipient (through contractor in the case of a subcontractor’s bill-of-lading.); c. include these requirements in all subcontracts issued pursuant to this contract when the subcontract involves the transport of equipment, material or commodities by ocean vessel.

ENERGY CONSERVATION

Applicability – all contracts except micro-purchases (\$10,000 or less, except for construction contracts over \$2,000).

Contractor shall comply with mandatory standards and policies relating to energy efficiency, stated in the state energy conservation plan issued in compliance with the Energy Policy & Conservation Act.

ACCESS TO RECORDS AND REPORTS

Applicability – as shown below. These requirements do not apply to micro-purchases (\$10,000 or less, except for construction contracts over \$2,000).

The following access to records requirements apply to this Contract:

1. Where the purchaser is not a State but a local government and is an FTA recipient or a subgrantee of FTA recipient in accordance with 49 CFR 18.36(i), contractor shall provide the purchaser, the FTA, the US Comptroller General or their authorized representatives access to any books, documents, papers and contractor records which are pertinent to this contract for the purposes of making audits, examinations, excerpts and transcriptions. Contractor shall also, pursuant to 49 CFR 633.17, provide authorized FTA representatives, including any PMO contractor, access to contractor's records and construction sites pertaining to a capital project, defined at 49 USC 5302(a)1, which is receiving FTA assistance through the programs described at 49 USC 5307, 5309 or 5311.
2. Where the purchaser is a State and is an FTA recipient or a subgrantee of FTA recipient in accordance with 49 CFR 633.17, contractor shall provide the purchaser, authorized FTA representatives, including any PMO Contractor, access to contractor's records and construction sites pertaining to a capital project, defined at 49 USC 5302(a)1, which receives FTA assistance through the programs described at 49 USC 5307, 5309 or 5311. By definition, a capital project excludes contracts of less than the simplified acquisition threshold currently set at \$150,000.
3. Where the purchaser enters into a negotiated contract for other than a small purchase or under the simplified acquisition threshold and is an institution of higher education, a hospital or other non-profit organization and is an FTA recipient or a subgrantee of FTA recipient in accordance with 49 CFR 19.48, contractor shall provide the purchaser, the FTA, the US Comptroller General or their authorized representatives, access to any books, documents, papers and record of the contractor which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts and transcriptions.
4. Where a purchaser which is an FTA recipient or a subgrantee of FTA recipient in accordance with 49 USC 5325(a) enters into a contract for a capital project or improvement (defined at 49 USC 5302(a)1) through other than competitive bidding, contractor shall make available records related to the contract to the purchaser, the Secretary of USDOT and the US Comptroller General or any authorized officer or employee of any of them for the purposes of conducting an audit and inspection.
5. Contractor shall permit any of the foregoing parties to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.
6. Contractor shall maintain all books, records, accounts and reports required under this contract for a period of not less than three (3) years after the date of termination or expiration of this contract, except in the event of litigation or settlement of claims arising from the performance of this contract, in which case contractor agrees to maintain same until the recipient, FTA Administrator, US Comptroller General, or any of their authorized representatives, have disposed of all such litigation, appeals, claims or exceptions related thereto. Re: 49 CFR 18.39(i)(11). FTA does not require the inclusion of these requirements in subcontracts.

FEDERAL CHANGES

Applicability – all contracts except micro-purchases (\$10,000 or less, except for construction contracts over \$2,000).

Contractor shall comply with all applicable FTA regulations, policies, procedures and directives, including without limitation those listed directly or by reference in the Master Agreement between the purchaser and FTA, as they may be amended or promulgated from time to time during the term of the contract. Contractor's failure to comply shall constitute a material breach of the contract.

RECYCLED PRODUCTS

Applicability – all contracts for items designated by the EPA, when the purchaser or contractor procures \$10,000 or more of one of these items during the current or previous fiscal year using Federal funds.

The contractor agrees to comply with all the requirements of Section 6002 of the Resource Conservation and Recovery Act (RCRA), as amended (42 U.S.C. 6962), including but not limited to the regulatory provisions of 40 CFR Part 247, and Executive Order 12873, as they apply to the procurement of the items designated in Subpart B of 40 CFR Part 247.

NO GOVERNMENT OBLIGATION TO THIRD PARTIES

Applicability – all contracts except micro-purchases (\$10,000 or less, except for construction contracts over \$2,000).

1. The recipient and contractor acknowledge and agree that, notwithstanding any concurrence by the US Government in or approval of the solicitation or award of the underlying contract, absent the express written consent by the US Government, the US Government is not a party to this contract and shall not be subject to any obligations or liabilities to the recipient, the contractor, or any other party (whether or not a party to that contract) pertaining to any matter resulting from the underlying contract.
2. Contractor agrees to include the above clause in each subcontract financed in whole or in part with FTA assistance. It is further agreed that the clause shall not be modified, except to identify the subcontractor who will be subject to its provisions.

PROGRAM FRAUD AND FALSE OR FRAUDULENT STATEMENTS OR RELATED ACTS

1. Contractor acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 USC 3801 et seq. and USDOT regulations, "Program Fraud Civil Remedies," 49 CFR 31, apply to its actions pertaining to this project. Upon execution of the underlying contract, contractor certifies or affirms the truthfulness and accuracy of any statement it has made, it makes, it may make, or causes to be made, pertaining to the underlying contract or FTA assisted project for which this contract work is being performed. In addition to other penalties that may be applicable, contractor further acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submittal, or certification, the US Government reserves the right to impose the penalties of the Program Fraud Civil Remedies Act (1986) on contractor to the extent the US Government deems appropriate.
2. If contractor makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submittal, or certification to the US Government under a contract connected with a project that is financed in whole or in part with FTA assistance under the authority of 49 USC 5307, the Government reserves the right to impose the penalties of 18 USC 1001 and 49 USC 5307(n)(1) on contractor, to the extent the US Government deems appropriate.
3. Contractor shall include the above two clauses in each subcontract financed in whole or in part with FTA assistance. The clauses shall not be modified, except to identify the subcontractor who will be subject to the provisions.

TERMINATION

Applicability – all contracts more than \$10,000, except contracts with nonprofit organizations and institutions of higher learning, where the threshold is \$150,000.

- a. Termination for Convenience (General Provision) the recipient may terminate this contract, in whole or in part, at any time by written notice to contractor when it is in the recipient's best interest. Contractor shall be paid its costs, including contract close-out costs, and profit on work performed up to the time of termination. Contractor shall promptly submit its termination claim to the recipient. If contractor is in possession of any of the recipient's property, contractor shall account for same, and dispose of it as the recipient directs.
- b. Termination for Default [Breach or Cause] (General Provision) If contractor does not deliver items in accordance with the contract delivery schedule, or, if the contract is for services, and contractor fails to perform in the manner called for in the contract, or if contractor fails to comply with any other provisions of the contract, the recipient may terminate this contract for default. Termination shall be effected by serving a notice of termination to contractor setting forth the manner in which contractor is in default. Contractor shall only be paid the contract price for supplies delivered and accepted, or for services performed in accordance with the manner of performance set forth in the contract. If it is later determined by the recipient that contractor had an excusable reason for not performing, such as a strike, fire, or flood, events which are not the fault of or are beyond the control of contractor, the recipient, after setting up a new delivery or performance schedule, may allow contractor to continue work, or treat the termination as a termination for convenience.
- c. Opportunity to Cure (General Provision) the recipient in its sole discretion may, in the case of a termination for breach or default, allow contractor an appropriately short period of time in which to cure the defect. In such case, the notice of termination shall state the time period in which cure is permitted and other appropriate conditions. If contractor fails to remedy to the recipient's satisfaction the breach or default or any of the terms, covenants, or conditions of this Contract within ten (10) days after receipt by contractor or written notice from the recipient setting forth the nature of said breach or default, the recipient shall have the right to terminate the Contract without any further obligation to contractor. Any such termination for default shall not in any way operate to preclude the recipient from also pursuing all available remedies against contractor and its sureties for said breach or default.
- d. Waiver of Remedies for any Breach In the event that the recipient elects to waive its remedies for any breach by contractor of any covenant, term or condition of this Contract, such waiver by the recipient shall not limit its remedies for any succeeding breach of that or of any other term, covenant, or condition of this Contract.
- e. Termination for Convenience (Professional or Transit Service Contracts) the recipient, by written notice, may terminate this contract, in whole or in part, when it is in the recipient's interest. If the contract is terminated, the recipient shall be liable only for payment under the payment provisions of this contract for services rendered before the effective date of termination.
- f. Termination for Default (Supplies and Service) If contractor fails to deliver supplies or to perform the services within the time specified in this contract or any extension or if the contractor fails to comply with any other provisions of this contract, the recipient may terminate this contract for default. The recipient shall terminate by delivering to contractor a notice of termination specifying the nature of default. Contractor shall only be paid the contract price for supplies delivered and accepted, or services performed in accordance with the manner or performance set forth in this contract. If, after termination for failure to fulfill contract obligations, it is determined that contractor was not in default, the rights and obligations of the parties shall be the same as if termination had been issued for the recipient's convenience.
- g. Termination for Default (Transportation Services) if contractor fails to pick up the commodities or to perform the services, including delivery services, within the time specified in this contract or any extension or if contractor fails to comply with any other provisions of this contract, the recipient may terminate this contract for default. The recipient shall terminate by delivering to contractor a notice of termination specifying the nature of default. Contractor shall only be paid the contract price for services performed in accordance with the manner of performance set forth in this contract. If this contract is terminated while contractor has possession of the recipient goods, contractor shall, as directed by the recipient, protect and preserve the goods until surrendered to the recipient or its agent. Contractor and the recipient shall agree on payment for the preservation and protection of goods. Failure to agree on an amount shall be resolved under the Dispute clause. If, after

termination for failure to fulfill contract obligations, it is determined that contractor was not in default, the rights and obligations of the parties shall be the same as if termination had been issued for the recipient's convenience.

- h. Termination for Default (Construction) If contractor refuses or fails to prosecute the work or any separable part, with the diligence that will insure its completion within the time specified, or any extension, or fails to complete the work within this time, or if contractor fails to comply with any other provisions of this contract, the recipient may terminate this contract for default. the recipient shall terminate by delivering to contractor a notice of termination specifying the nature of default. In this event, the recipient may take over the work and complete it by contract or otherwise, and may take possession of and use any materials, appliances, and plant on the work site necessary for completing the work. Contractor and its sureties shall be liable for any damage to the recipient resulting from contractor's refusal or failure to complete the work within specified time, whether or not contractor's right to proceed with the work is terminated. This liability includes any increased costs incurred by the recipient in completing the work. Contractor's right to proceed shall not be terminated nor shall contractor be charged with damages under this clause if: (1). Delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of contractor. Examples of such causes include: acts of God, acts of the recipient, acts of another contractor in the performance of a contract with the recipient, epidemics, quarantine restrictions, strikes, freight embargoes; and (2). Contractor, within 10 days from the beginning of any delay, notifies the recipient in writing of the causes of delay. If in the recipient's judgment, delay is excusable, the time for completing the work shall be extended. The recipient's judgment shall be final and conclusive on the parties, but subject to appeal under the Disputes clauses. If, after termination of contractor's right to proceed, it is determined that contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if termination had been issued for the recipient's convenience.
- i. Termination for Convenience or Default (Architect & Engineering) the recipient may terminate this contract in whole or in part, for the recipient's convenience or because of contractor's failure to fulfill contract obligations. The recipient shall terminate by delivering to contractor a notice of termination specifying the nature, extent, and effective date of termination. Upon receipt of the notice, contractor shall (1) immediately discontinue all services affected (unless the notice directs otherwise), and (2) deliver to the recipient all data, drawings, specifications, reports, estimates, summaries, and other information and materials accumulated in performing this contract, whether completed or in process. If termination is for the recipient's convenience, it shall make an equitable adjustment in the contract price but shall allow no anticipated profit on unperformed services. If termination is for contractor's failure to fulfill contract obligations, the recipient may complete the work by contract or otherwise and contractor shall be liable for any additional cost incurred by the recipient. If, after termination for failure to fulfill contract obligations, it is determined that contractor was not in default, the rights and obligations of the parties shall be the same as if termination had been issued for the recipient's convenience.
- j. Termination for Convenience or Default (Cost-Type Contracts) the recipient may terminate this contract, or any portion of it, by serving a notice of termination on contractor. The notice shall state whether termination is for convenience of the recipient or for default of contractor. If termination is for default, the notice shall state the manner in which contractor has failed to perform the requirements of the contract. Contractor shall account for any property in its possession paid for from funds received from the recipient, or property supplied to contractor by the recipient. If termination is for default, the recipient may fix the fee, if the contract provides for a fee, to be paid to contractor in proportion to the value, if any, of work performed up to the time of termination. Contractor shall promptly submit its termination claim to the recipient and the parties shall negotiate the termination settlement to be paid to contractor. If termination is for the recipient's convenience, contractor shall be paid its contract closeout costs, and a fee, if the contract provided for payment of a fee, in proportion to the work performed up to the time of termination. If, after serving a notice of termination for default, the recipient determines that contractor has an excusable reason for not performing, such as strike, fire, flood, events which are not the fault of and are beyond the control of contractor, the recipient, after setting up a new work schedule, may allow contractor to continue work, or treat the termination as a termination for convenience.

CONTRACTS INVOLVING FEDERAL PRIVACY ACT REQUIREMENTS

Applicability – when a grantee maintains files on drug and alcohol enforcement activities for FTA, and those files are organized so that information could be retrieved by personal identifier, the Privacy Act requirements apply to all contracts except micro-purchases (\$10,000 or less, except for construction contracts over \$2,000). The following requirements apply to the Contractor and its employees that administer any system of records on behalf of the Federal Government under any contract:

1. The Contractor agrees to comply with, and assures the compliance of its employees with, the information restrictions and other applicable requirements of the Privacy Act of 1974, 5 U.S.C. § 552a. Among other things, the Contractor agrees to obtain the express consent of the Federal Government before the Contractor or its employees operate a system of records on behalf of the Federal Government. The Contractor understands that the requirements of the Privacy Act, including the civil and criminal penalties for violation of that Act, apply to those individuals involved, and that failure to comply with the terms of the Privacy Act may result in termination of the underlying contract.
2. The Contractor also agrees to include these requirements in each subcontract to administer any system of records on behalf of the Federal Government financed in whole or in part with Federal assistance provided by FTA.

CIVIL RIGHTS REQUIREMENTS

Applicability – all contracts except micro-purchases (\$10,000 or less, except for construction contracts over \$2,000).

The following requirements apply to the underlying contract: The Recipient understands and agrees that it must comply with applicable Federal civil rights laws and regulations, and follow applicable Federal guidance, except as the Federal Government determines otherwise in writing. Therefore, unless a Recipient or Program, including an Indian Tribe or the Tribal Transit Program, is specifically exempted from a civil rights statute, FTA requires compliance with that civil rights statute, including compliance with equity in service: a. Nondiscrimination in Federal Public Transportation Programs. The Recipient agrees to, and assures that each Third Party Participant will, comply with Federal transit law, 49 U.S.C. § 5332 (FTA's "Nondiscrimination" statute):

- a. FTA's "Nondiscrimination" statute prohibits discrimination on the basis of: (a) Race, (b) Color, (c) Religion, (d) National origin, (e) Sex, (f) Disability, (g) Age, or (h) Gender identity and (2) The FTA "Nondiscrimination" statute's prohibition against discrimination includes: (a) Exclusion from participation, (b) Denial of program benefits, or (c) Discrimination, including discrimination in employment or business opportunity, (3) Except as FTA determines otherwise in writing: (a) General. Follow: 1 The most recent edition of FTA Circular 4702.1, "Title VI Requirements and Guidelines for Federal Transit Administration Recipients," to the extent consistent with applicable Federal laws, regulations, and guidance, and 2 Other applicable Federal guidance that may be issued, but (b) Exception for the Tribal Transit Program. FTA does not require an Indian Tribe to comply with FTA program-specific guidelines for Title VI when administering its projects funded under the Tribal Transit Program.
- b. Nondiscrimination – Title VI of the Civil Rights Act. The Recipient agrees to, and assures that each Third Party Participant will: (1) Prohibit discrimination based on: (a) Race, (b) Color, or (c) National origin, (2) Comply with: (a) Title VI of the Civil Rights Act of 1964, as amended, 42 U.S.C. § 2000d et seq., (b) U.S. DOT regulations, "Nondiscrimination in Federally-Assisted Programs of the Department of Transportation – Effectuation of Title VI of the Civil Rights Act of 1964," 49 C.F.R. part 21, and (c) Federal transit law, specifically 49 U.S.C. § 5332, as stated in the preceding section a, and (3) Except as FTA determines otherwise in writing, follow: (a) The most recent edition of FTA Circular 4702.1, "Title VI and Title VI-Dependent Guidelines for Federal Transit Administration Recipients," to the extent consistent with applicable Federal laws, regulations, and guidance. (b) U.S. DOJ, "Guidelines for the enforcement of Title VI, Civil Rights Act of 1964," 28 C.F.R. § 50.3, and (c) Other applicable Federal guidance that may be issued.
- c. Equal Employment Opportunity. (1) Federal Requirements and Guidance. The Recipient agrees to, and assures that each Third Party Participant will, prohibit discrimination on the basis of race, color, religion, sex, or national origin, and: (a) Comply with Title VII of the Civil Rights Act of 1964,

as amended, 42 U.S.C. § 2000e et seq., (b) Facilitate compliance with Executive Order No. 11246, "Equal Employment Opportunity," as amended by Executive Order No. 11375, "Amending Executive Order No. 11246, Relating to Equal Employment Opportunity," 42 U.S.C. § 2000e note, (c) Comply with Federal transit law, specifically 49 U.S.C. § 5332, as stated in section a, and (d) Comply with other applicable EEO laws and regulations, as provided in Federal guidance, including laws and regulations prohibiting discrimination on the basis of disability, except as the Federal Government determines otherwise in writing, (2) General. The Recipient agrees to: (a) Ensure that applicants for employment are employed and employees are treated during employment without discrimination on the basis of their: 1 Race, 2 Color, 3 Religion, 4 Sex, 5 Disability, 6 Age, or 7 National origin, (b) Take affirmative action that includes, but is not limited to: 1 Recruitment advertising, 2 Recruitment, 3 Employment, 4 Rates of pay, 5 Other forms of compensation, 6 Selection for training, including apprenticeship, 7 Upgrading, 8 Transfers, 9 Demotions, 10 Layoffs, and 11 Terminations, but (b) Indian Tribe. Title VII of the Civil Rights Act of 1964, as amended, exempts Indian Tribes under the definition of "Employer". (3) Equal Employment Opportunity Requirements for Construction Activities. In addition to the foregoing, when undertaking "construction" as recognized by the U.S. Department of Labor (U.S. DOL), the Recipient agrees to comply, and assures the compliance of each Third Party Participant, with: (a) U.S. DOL regulations, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor," 41 C.F.R. chapter 60, and (b) Executive Order No. 11246, "Equal Employment Opportunity," as amended by Executive Order No. 11375, "Amending Executive Order No. 11246, Relating to Equal Employment Opportunity," 42 U.S.C. § 2000e note.

- d. Disadvantaged Business Enterprise. To the extent authorized by applicable Federal law, the Recipient agrees to facilitate, and assures that each Third Party Participant will facilitate, participation by small business concerns owned and controlled by socially and economically disadvantaged individuals, also referred to as "Disadvantaged Business Enterprises" (DBEs), in the Project as follows: 1) Requirements. The Recipient agrees to comply with: (a) Section 1101(b) of MAP-21, 23 U.S.C. § 101 note, (b) U.S. DOT regulations, "Participation by Disadvantaged Business Enterprises in Department of Transportation Financial Assistance Programs," 49 C.F.R. part 26, and (c) Federal transit law, specifically 49 U.S.C. § 5332, as stated in section a, (2) Assurance. As required by 49 C.F.R. § 26.13(a), (b) DBE Program Requirements. Recipients receiving planning, capital and/or operating assistance that will award prime third party contracts exceeding \$250,000 in a Federal fiscal year must: 1 Have a DBE program meeting the requirements of 49 C.F.R. part 26, 2 implement a DBE program approved by FTA, and 3 establish an annual DBE participation goal, (c) Special Requirements for a Transit Vehicle Manufacturer. The Recipient understands and agrees that each transit vehicle manufacturer, as a condition of being authorized to bid or propose on FTA-assisted transit vehicle procurements, must certify that it has complied with the requirements of 49 C.F.R. part 26, (d) the Recipient provides assurance that: The Recipient shall not discriminate on the basis of race, color, national origin, or sex in the award and performance of any DOT-assisted contract or in the administration of its DBE program or the requirements of 49 C.F.R. part 26. The Recipient shall take all necessary and reasonable steps under 49 C.F.R. part 26 to ensure nondiscrimination in the award and administration of DOT-assisted contracts. The Recipient's DBE program, as required by 49 C.F.R. part 26 and as approved by DOT, is incorporated by reference in this agreement. Implementation of this program is a legal obligation and failure to carry out its terms shall be treated as a violation of this agreement. Upon notification to the Recipient of its failure to carry out its approved program, the Department may impose sanctions as provided for under 49 C.F.R. part 26 and may, in appropriate cases, refer the matter for enforcement under 18 U.S.C. § 1001 and/or the Program Fraud Civil Remedies Act of 1986, 31 U.S.C. § 3801 et seq., (2) Exception for the Tribal Transit Program. FTA exempts Indian tribes from the Disadvantaged Business Enterprise regulations at 49 C.F.R. part 26 under MAP-21 and previous legislation.
- e. Nondiscrimination on the Basis of Sex. The Recipient agrees to comply with Federal prohibitions against discrimination on the basis of sex, including: (1) Title IX of the Education Amendments of 1972, as amended, 20 U.S.C. § 1681 et seq., (2) U.S. DOT regulations, "Nondiscrimination on the Basis of Sex in Education Programs or Activities Receiving Federal Financial Assistance," 49 C.F.R. part 25, and (3) Federal transit law, specifically 49 U.S.C. § 5332, as stated in section a,

- f. **Nondiscrimination on the Basis of Age.** The Recipient agrees to comply with Federal prohibitions against discrimination on the basis of age, including: (1) The Age Discrimination in Employment Act (ADEA), 29 U.S.C. §§ 621 – 634, which prohibits discrimination on the basis of age, (2) U.S. Equal Employment Opportunity Commission (U.S. EEOC) regulations, “Age Discrimination in Employment Act,” 29 C.F.R. part 1625, which implements the ADEA, (3) The Age Discrimination Act of 1975, as amended, 42 U.S.C. § 6101 et seq., which prohibits discrimination against individuals on the basis of age in the administration of programs or activities receiving Federal funds, (4) U.S. Health and Human Services regulations, “Nondiscrimination on the Basis of Age in Programs or Activities Receiving Federal Financial Assistance,” 45 C.F.R. part 90, which implements the Age Discrimination Act of 1975, and (5) Federal transit law, specifically 49 U.S.C. § 5332, as stated in section a.
- g. **Nondiscrimination on the Basis of Disability.** The Recipient agrees to comply with the following Federal prohibitions pertaining to discrimination against seniors or individuals with disabilities: (1) Federal laws, including: (a) Section 504 of the Rehabilitation Act of 1973, as amended, 29 U.S.C. § 794, which prohibits discrimination on the basis of disability in the administration of federally funded programs or activities, (b) The Americans with Disabilities Act of 1990 (ADA), as amended, 42 U.S.C. § 12101 et seq., which requires that accessible facilities and services be made available to individuals with disabilities, 1 General. Titles I, II, and III of the ADA apply to FTA Recipients, but 2 Indian Tribes. While Titles II and III of the ADA apply to Indian Tribes, Title I of the ADA exempts Indian Tribes from the definition of “employer,” (c) The Architectural Barriers Act of 1968, as amended, 42 U.S.C. § 4151 et seq., which requires that buildings and public accommodations be accessible to individuals with disabilities, (d) Federal transit law, specifically 49 U.S.C. § 5332, which now includes disability as a prohibited basis for discrimination, and (e) Other applicable laws and amendments pertaining to access for elderly individuals or individuals with disabilities, (2) Federal regulations, including: (a) U.S. DOT regulations, “Transportation Services for Individuals with Disabilities (ADA),” 49 C.F.R. part 37, (b) U.S. DOT regulations, “Nondiscrimination on the Basis of Disability in Programs and Activities Receiving or Benefiting from Federal Financial Assistance,” 49 C.F.R. part 27, (c) U.S. DOT regulations, “Transportation for Individuals with Disabilities: Passenger Vessels,” 49 C.F.R. part 39, (d) Joint U.S. Architectural and Transportation Barriers Compliance Board (U.S. ATBCB) and U.S. DOT regulations, “Americans With Disabilities (ADA) Accessibility Specifications for Transportation Vehicles,” 36 C.F.R. part 1192 and 49 C.F.R. part 38, (e) U.S. DOJ regulations, “Nondiscrimination on the Basis of Disability in State and Local Government Services,” 28 C.F.R. part 35, (f) U.S. DOJ regulations, “Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities,” 28 C.F.R. part 36, (g) U.S. EEOC, “Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act,” 29 C.F.R. part 1630, (h) U.S. Federal Communications Commission regulations, “Telecommunications Relay Services and Related Customer Premises Equipment for Persons with Disabilities,” 47 C.F.R. part 64, Subpart F, (i) U.S. ATBCB regulations, “Electronic and Information Technology Accessibility Standards,” 36 C.F.R. part 1194, and (j) FTA regulations, “Transportation for Elderly and Handicapped Persons,” 49 C.F.R. part 609, and (3) Other applicable Federal civil rights and nondiscrimination guidance.
- h. **Drug or Alcohol Abuse - Confidentiality and Other Civil Rights Protections.** The Recipient agrees to comply with the confidentiality and civil rights protections of: (1) The Drug Abuse Office and Treatment Act of 1972, as amended, 21 U.S.C. § 1101 et seq., (2) The Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970, as amended, 42 U.S.C. § 4541 et seq., and (3) The Public Health Service Act, as amended, 42 U.S.C. §§ 290dd – 290dd-2.
- i. **Access to Services for People with Limited English Proficiency.** Except as the Federal Government determines otherwise in writing, the Recipient agrees to promote accessibility of public transportation services to people whose understanding of English is limited by following: 1) Executive Order No. 13166, “Improving Access to Services for Persons with Limited English Proficiency,” August 11, 2000, 42 U.S.C. § 2000d-1 note, and (2) U.S. DOT Notice, “DOT Policy Guidance Concerning Recipients’ Responsibilities to Limited English Proficiency (LEP) Persons,” 70 Fed. Reg. 74087, December 14, 2005.

- j. Other Nondiscrimination Laws. Except as the Federal Government determines otherwise in writing, the Recipient agrees to: (1) Comply with other applicable Federal nondiscrimination laws and regulations, and (2) Follow Federal guidance prohibiting discrimination.
- k. Remedies. Remedies for failure to comply with applicable Federal Civil Rights laws and Federal regulations may be enforced as provided in those Federal laws or Federal regulations.

DISADVANTAGED BUSINESS ENTERPRISE

Applicability – contracts over \$10,000 awarded on the basis of a bid or proposal offering to use DBEs:

- a. This contract is subject to the requirements of Title 49, Code of Federal Regulations, Part 26, and Participation by Disadvantaged Business Enterprises in Department of Transportation Financial Assistance Programs. The national goal for participation of Disadvantaged Business Enterprises (DBE) is 10%. The recipient's overall goal for DBE participation is listed elsewhere. If a separate contract goal for DBE participation has been established for this procurement, it is listed elsewhere.
- b. The contractor shall not discriminate on the basis of race, color, religion, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of this contract. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the municipal corporation deems appropriate. Each subcontract the contractor signs with a subcontractor must include the assurance in this paragraph (see 49 CFR 26.13(b)).
- c. If a separate contract goal has been established, Bidders/offerors are required to document sufficient DBE participation to meet these goals or, alternatively, document adequate good faith efforts to do so, as provided for in 49 CFR 26.53.
- d. If no separate contract goal has been established, the successful bidder/offeror will be required to report its DBE participation obtained through race-neutral means throughout the period of performance.
- e. The contractor is required to pay its subcontractors performing work related to this contract for satisfactory performance of that work no later than 30 days after the contractor's receipt of payment for that work from the recipient. In addition, the contractor may not hold retainage from its subcontractors or must return any retainage payments to those subcontractors within 30 days after the subcontractor's work related to this contract is satisfactorily completed or must return any retainage payments to those subcontractors within 30 days after incremental acceptance of the subcontractor's work by the recipient and contractor's receipt of the partial retainage payment related to the subcontractor's work.
- f. The contractor must promptly notify the recipient whenever a DBE subcontractor performing work related to this contract is terminated or fails to complete its work, and must make good faith efforts to engage another DBE subcontractor to perform at least the same amount of work. The contractor may not terminate any DBE subcontractor and perform that work through its own forces or those of an affiliate without prior written consent of the recipient.

PROMPT PAYMENT

Applicability – all contracts except micro-purchases (\$10,000 or less, except for construction contracts over \$2,000).

The prime contractor agrees to pay each subcontractor under this prime contract for satisfactory performance of its contract no later than 30 days from the receipt of each payment the prime contract receives from the Recipient. The prime contractor agrees further to return retainage payments to each subcontractor within 30 days after the subcontractors work is satisfactorily completed. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of the Recipient. This clause applies to both DBE and non-DBE subcontracts.

INCORPORATION OF FEDERAL TRANSIT ADMINISTRATION (FTA) TERMS

Applicability – all contracts except micro-purchases (\$10,000 or less, except for construction contracts over \$2,000).

The preceding provisions include, in part, certain Standard Terms & Conditions required by USDOT, whether or not expressly stated in the preceding contract provisions. All USDOT-required contractual provisions, as stated in FTA Circular 4220.1F, are hereby incorporated by reference. Anything to the contrary herein notwithstanding, all FTA mandated terms shall be deemed to control in the event of a conflict with other provisions contained in this Agreement. The contractor shall not perform any act, fail to perform any act, or refuse to comply with any request that would cause the recipient to be in violation of FTA terms and conditions.

(NAME OF TRANSIT AGENCY)

THIRD PARTY CONTRACT

(CONTRACT NUMBER)

This AGREEMENT is entered into this (day) of (month) (year)
by and between the (hereinafter referred to as
“Agency”, located at

and

(TRANSIT AGENCY ADDRESS)

(hereinafter referred to as “Contractor”),

(NAME OF VENDOR COMPANY)

located at

(VENDOR ADDRESS)

WITNESSETH:

In consideration of the covenants, recitals, promises, representations and agreements herein set forth, the Agency and the Contractor do hereby expressly agree as follows:

ARTICLE I SCOPE OF WORK

It is mutually understood and agreed that:

The Contractor shall perform in accordance with this contract, and shall furnish all materials, performance of work, and services required to perform and complete in a sound, economical and efficient manner, and in accordance with provisions hereof and all applicable laws, all the work required for the following project:

(SCOPE OF WORK TO BE PERFORMED)

ARTICLE II COMPONENT PARTS OF THIS CONTRACT

This contract consists of this agreement and the following component parts. Components which are incorporated by reference and made part of this contract even if not attached hereto are referenced by title, date or other method of identification.

(DOCUMENT 1)

(DOCUMENT 2)

(DOCUMENT 3)

(DOCUMENT 4)

(DOCUMENT 5)

(DOCUMENT 6)

Attachment A -

(FEDERAL CONTRACT CLAUSES)

Appendix A - Prohibition of Discrimination in State Contracts.

Any inconsistency in the terms associated with this Contract will be resolved by the following order of precedence:

- (a) Published addenda modifying the
- (b) The contents of the
- (c) Contractor's response to the requirements.

ARTICLE III TIME

It is mutually understood and agreed that the Contractor will commence the work to be performed under this contract after this document is approved by the Michigan Department of Transportation. The signed and executed Third Party contract will serve as the "Notice to Proceed" subject to authorized adjustments, completion shall be achieved, and the following

(SCOPE OF WORK FROM ARTICLE I)

shall be delivered according to the Terms and Conditions of this Agreement by

(DATE)

ARTICLE IV PRICE

It is mutually understood and agreed that the Agency will pay in current funds to the contractor,

(DEFINE TERMS (LUMPSUM, ETC.) SUBCONTRACT DOLLAR AMOUNT AND ANY LOCAL FUND USED)

for completion of the work described in Article I as specified, subject to any deduction or additions provided by Change Order as provided in the Terms and Conditions. The total costs are not to exceed the Contract maximum amount of \$

The Contractor agrees that the costs reported to the Agency for this Contract will represent only those items which are properly chargeable in accordance with this Contract. All travel costs billed will follow the State of Michigan's vehicle and travel rates. Current travel rates can be found on the Department of Technology, Management and Budget's website at:

<https://www.michigan.gov/dtmb>. The Contractor also certifies that it has read the Contract terms and has made itself aware of the applicable laws, regulations, and terms of this Contract that apply to the reporting of costs incurred under the terms of this Contract.

If progress payments are made for costs incurred by the contractor prior to the completion of work, the Agency shall obtain adequate security for those payments; and, the Contractor will provide sufficient documentation to substantiate the work performed for which payment is requested.

The AGENCY agrees to pay each subcontractor for the satisfactory completion of work associated with the subcontract no later than ten (10) calendar days from the receipt of each payment the AGENCY receives from the DEPARTMENT. The AGENCY agrees further to return retainage payments to each subcontractor within ten (10) calendar days after the subcontractor's work is satisfactorily completed. Any delay or postponement from these time frames may occur only upon receipt of written approval from the DEPARTMENT. These requirements are also applicable to all sub-tier subcontractors and will be made a part of all subcontract agreements.

This prompt payment provision is a requirement of Title 49 CFR, Part 26.29, and does not confer third-party beneficiary right or other direct right to a subcontractor against the DEPARTMENT. This provision applies to both DBE and non-DBE subcontractors.

Add other sections of text as needed:

ARTICLE V MISCELLANEOUS

ALL terms and conditions included in the prime contract are incorporated in the subcontract. In the event of a conflict between the terms and conditions of the subcontract and those of the prime contract, the terms and conditions of the prime contract shall prevail.

This contract shall in all respects be governed by, and construed in accordance with, the laws of the State of Michigan.

In witness whereof the parties hereto have caused this agreement to be executed on the day and year first above written, in several original counterparts, each of which shall be deemed to constitute an original having identical legal effect.

CONTRACTOR:

(NAME OF VENDOR COMPANY)

SIGNATURE

TITLE

DATE

AGENCY:

(NAME OF TRANSIT AGENCY)

SIGNATURE

TITLE

DATE

INSTRUCTIONS

An MDOT - approved third party subcontract is required between the transit agency and contractor for purchases of more than \$100,000. This template is intended to be a guide to developing a third-party subcontract. Your agency or unit of government may require additional contract language. This may be language for indemnification, severability, liquidated damages, force majeure events, assignment, complete agreement, and/or waivers. This is not to be construed as a full and complete list. Consult an attorney or your legal department if you need more information.

NAME OF TRANSIT AGENCY- This is the name of the entity on the project authorization awarding the funds. Use as complete of an agency name as possible. For a transit agency that's a unit of county or city government, this will likely be the name of the city or the county board of commissioners.

CONTRACT NUMBER - This is the project authorization and subcontract number. The project authorization number is the Agreement Number and Authorization Number at the upper right of the grant contract. The subcontract number S is followed by the number of subcontracts the project authorization has. For example, the first subcontract on Agreement Number 2017-0235 and Authorization Number P11 should be written 2017-0235/P11/S1.

NAME OF VENDOR COMPANY AND VENDOR ADDRESS - This is the name and address of the vendor company providing the product or service. It must match the vendor company name in the vendor company's submitted proposal, bid or quote.

SCOPE OF WORK TO BE PERFORMED - This is the task the vendor company must provide. It is typically a description of the work and a reference to the issued solicitation. A typical scope of work might be "county-wide needs assessment study as described in the City of Hartford's Request for Proposal RFP 2016-7" or "Manufacture and delivery of four 29ft buses".

DOCUMENTS 1, 2, 3, 4, 5, 6 - These are attachments to the subcontract. Two required attachments are the solicitation as issued and the vendor company's submitted proposal, bid or quote. Your local agency may require additional attachments. You need to make sure the appendices, exhibits and or attachments are numbered and lettered correctly and match your contract language.

FEDERAL CONTRACT CLAUSES - Two other attachments are required after DOCUMENT 6. They are the federal contract clauses issued with the solicitation and the Prohibition of Discrimination in State Contracts (Appendix A). The name of the federal contract clauses appears at the top of page 1 of the clauses.

DEFINE TERMS (LUMP SUM, ETC.) AND DOLLAR AMOUNT - This is the method how the vendor company will be paid. It will typically be by lumpsum for a capital item like a bus or piece of maintenance equipment. It may be per unit cost for an agreed upon number of radios with a not to exceed price. It may be by progress payments per month or per week for work completed for a vendor company conducting a study or providing construction services on a large project.

PROMPT PAYMENT PROVISION LANGUAGE ON PAGE 3 - The federal requirements are payment no later than 30 days but MDOT has a more stringent requirement of payment no later than 10 days.

NAME OF VENDOR COMPANY, SIGNATURE, TITLE, DATE - This is the name of the vendor company providing the product or service. The signature and title must match the person authorized to sign for the vendor company as specified in the vendor company's submitted proposal, bid or quote.

NAME OF TRANSIT AGENCY, SIGNATURE, TITLE DATE - This is the name of the entity on the project authorization awarding the funds. The signature and title must match the person authorized to sign for the transit agency.

SECTION 311000 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. Removing above- and below-grade site improvements.
 - 6. Disconnecting, capping or sealing, and removing or abandoning site utilities in place.
 - 7. Temporary erosion and sedimentation control.
- B. Related Requirements:
 - 1. Section 015000 "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. 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 in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.
- D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction.
- F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 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.

1.5 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. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.
- C. Burning: Documentation of compliance with burning requirements and permitting of authorities having jurisdiction. Identify location(s) and conditions under which burning will be performed.

1.6 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. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises.
- C. Utility Locator Service: Notify One Call for area where Project is located before site clearing.
- D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.
- E. Tree- and Plant-Protection Zones: Protect according to requirements.
- F. Retain "Soil Stripping, Handling, and Stockpiling" Paragraph below to suit Project.
- 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.

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 within temporary fencing clearly visible.
- 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.
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations.

3.4 EXISTING UTILITIES

- A. 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.
- B. 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 Engineer not less than two days in advance of proposed utility interruptions.
- C. Excavate for and remove underground utilities indicated to be removed.
- D. Removal of underground utilities is included in earthwork sections.

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 in diameter, obstructions, and debris to a depth of 18 inches below proposed 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, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

- A. Remove or till sod and grass before stripping topsoil.
- B. Strip topsoil to depth as required and 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 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 8 feet.
 - 2. Do not stockpile topsoil within protection zones.

3. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 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.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil and aggregate, 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

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 walks, pavements, turf and grasses, and plants.
 - 3. Excavating and backfilling for buildings and structures.
 - 4. Subbase course for concrete walks.
 - 5. Subbase course and base course for asphalt paving.
 - 6. Excavating and backfilling trenches for utilities and pits for buried utility structures.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
 - 2. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
 - 3. Section 312319 "Dewatering" for lowering and disposing of ground water during construction.
 - 4. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
 - 5. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed on top of bedding course alongside and over pipe in a trench, including haunches to support sides of pipe, otherwise known as the pipe bedding envelope.
 - 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 Engineer. 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 in width and more than 30 feet in length.
 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, 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. for bulk excavation or 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 maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom.
 2. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket.
- I. 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.
- J. Subbase Course: Aggregate or granular 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.
- K. 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.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
1. Geotextiles.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each imported soil material proposed for fill and backfill as follows:
1. Classification according to ASTM D 2487.
 2. Laboratory compaction curve according to ASTM D 1557.
- C. Pre-excavation 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.

1.6 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

1.7 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 Engineer.
- C. Utility Locator Service: Notify utility locator service, "One Call" 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 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, SW, SP, and according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GM, GC, SM, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, 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 D 2940; with at least 90 percent passing a 1-inch sieve and not more than 7 percent passing a No. 200 sieve. (Modified MDOT Class II Granular Material)

- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 294; with 100 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve. (MDOT 22A or 21AA Aggregates)
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with 100 percent passing a 2-inch sieve and not more than 5 percent passing a No. 200 sieve. (MDOT Class I Granular Material)
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve. (Modified MDOT Class II Granular Material)
- H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve. (MDOT Class 6A)
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and zero to 5 percent passing a No. 4 sieve. (MDOT 17A is Acceptable)
- J. Sand: ASTM C 33; fine aggregate.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile (Mirafi 140N): 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: As follows:
 - a. Grab Tensile Strength: 120 lbf; ASTM D 4632.
 - b. Grab Tensile Elongation: 50%; ASTM D 4632
 - c. Trapezoid Tear Strength: 50 lbf; ASTM D 4533.
 - d. CBR Puncture Strength: 310 lbf; ASTM D 6241.
 - 2. Apparent Opening Size: No. 70 sieve, maximum; ASTM D 4751.
 - 3. Permittivity: 1.7 per second, minimum; ASTM D 4491.
 - 4. Flow Rate: 135 gal/min/ft²; ASTM 4491
 - 5. UV Stability: 70 percent after 500 hours' exposure; ASTM D 4355.
- B. Separation Geotextile (Mirafi 600X): 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: As follows:
 - a. Grab Tensile Strength: 315 lbf; ASTM D 4632.
 - b. Grab Tensile Elongation: 15%; ASTM D 4632
 - c. Trapezoid Tear Strength: 120 lbs; ASTM D 4533
 - d. CBR Puncture Strength: 900 lbf; ASTM D 6241
 - 2. Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.
 - 3. Permittivity: 0.05 per second, minimum; ASTM D 4491.

4. Flow Rate: 4 gal/min/ft²; ATMD 4491
5. UV Stability: 70 percent after 500 hours' exposure; ASTM D 4355.

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. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. 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.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives without explicit permission from the Engineer.

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 outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches 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 beneath bottom of concrete slabs-on-grade.
 - f. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. 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. 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. 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.

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 higher than top of pipe or conduit unless otherwise indicated.
1. Clearance: 9 inches each side of pipe or conduit.
- C. Trench Bottoms: Excavate trenches 4 inches 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 deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. 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.

3.8 SUBGRADE INSPECTION

- A. Notify Engineer when excavations have reached required subgrade.
- B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons 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.

2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, 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, may be used when approved by Engineer.
 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

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.
- B. All temporary stockpiles shall be uniformly graded to create a level, non-ponding surface upon completion.

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 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.

3.13 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.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 12 inches in loose depth for material compacted by heavy compaction equipment and not more than 6 inches 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 D 1557:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material to 98 percent.
 - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material to 95 percent.
 - 3. Under turf or unpaved areas, scarify and recompact top 6 inches 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 95 percent.
- D. Maintain ground water a minimum of 18 inches below vibratory compaction equipment as well as 12 inches below the bottom of all excavations.

3.15 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.
 - 2. Walks: Plus or minus 1/2 inch.
 - 3. Pavements: Plus or minus 1/2 inch.

3.16 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase 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 (when called for on plans).

2. Place base course material over subbase course under hot-mix asphalt pavement.
 3. Shape subbase and base course to required crown elevations and cross-slope grades.
 4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
 5. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 1557.
- C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.17 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. 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.
- C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, 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 (sub-base, aggregate base), at least one test for every 1500 sq. ft. 12 inches or less of paved area or building slab.
 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length.
 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 250 feet or less of trench length.
 4. Hot Mix Asphalt: One test per lift per 500 syd.
- D. 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.

3.18 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 Engineer; 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.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus unsatisfactory soil and waste materials, 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. Spread soil as directed by Engineer.

END OF SECTION

SECTION 312319 DEWATERING

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 construction dewatering.
- B. Related Requirements:
 - 1. Section 312000 "Earth Moving" for excavating, backfilling, site grading, and controlling surface-water runoff and ponding.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by dewatering operations. Submit before Work begins
- C. Record Drawings: Identify locations and depths of capped wells and well points and other abandoned-in-place dewatering equipment.

1.4 ACTION SUBMITTALS

- A. Shop Drawings: Dewatering silt/sedimentation traps/bags.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer with 3 or more years of related experience that has specialized in design of dewatering systems and dewatering work.

1.6 FIELD CONDITIONS

- A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements.
2. The geotechnical report is included elsewhere in Project Manual.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain 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.
 1. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.
 2. Prevent surface water from entering excavations by grading, dikes, or other means.
 3. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
 4. Remove dewatering system when no longer required for construction.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.
- C. Dewatering Sediment Bag: Sized to accommodate dewatering system capacity. Rated for 80 microns detaining both oil and sediment/silt.

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 dewatering operations.
 1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.

- D. Protect and maintain temporary erosion and sedimentation controls, during dewatering operations.

3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
 - 1. Space well points or wells at intervals required to provide sufficient dewatering.
 - 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.
- C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
- D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.3 OPERATION

- A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- B. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
 - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
 - 2. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
 - 3. Maintain piezometric water level a minimum of 24 inches below bottom of excavation.
- C. 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.
- D. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

3.4 FIELD QUALITY CONTROL

- A. Observation Wells: Provide observation wells or piezometers, take measurements, and maintain at least the minimum number indicated; additional observation wells may be required by authorities having jurisdiction.
 - 1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.

2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
 3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.
- B. Survey-Work Benchmarks: Resurvey benchmarks regularly during dewatering and maintain an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Engineer if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.
 - C. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.
 - D. Prepare reports of observations.

3.5 PROTECTION

- A. Protect and maintain dewatering system during dewatering operations.
- B. Promptly repair damages to adjacent facilities caused by dewatering.

END OF SECTION 312319

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. Hot-mix asphalt patching.
 - 2. Hot-mix asphalt paving.
 - 3. 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 sidewalks; and for separate concrete curbs, gutters, and driveway aprons.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include technical data and tested physical and performance properties.
 - 2. Job-Mix Designs: For each job mix proposed for the Work.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by Michigan Department of Transportation.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.
- C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the MDOT 2020 Standard Specification for Construction for asphalt paving work.
 - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.5 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.
 - 2. Tack Coat: Minimum surface temperature of 60 deg F.
 - 3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
 - 4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 5. Asphalt Surface Course: Minimum surface temperature of 60 deg F 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 D 692 sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D 1073, 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 D 242, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: ASTM D 6373 binder designation PG 64-28.
- B. Asphalt Cement: ASTM D 3381 for viscosity-graded material.
- C. Tack Coat: ASTM D 977 emulsified asphalt, or ASTM D 2397 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- D. Water: Potable.
- E. Undersealing Asphalt: ASTM D 3141 pumping consistency.

2.3 AUXILIARY MATERIALS

- A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled tires or asphalt shingles from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

- B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.
- C. Sand: ASTM D 1073, Grade No. 2 or No. 3.
- D. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications where indicated on the drawings.
- E. Joint Sealant: ASTM D 6690, Type II or III, hot-applied, single-component, polymer-modified bituminous sealant.

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. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Base Course: MDOT 13A, 3C, or 4EL.
 - 3. Surface Course: MDOT 13A, 4C or 4EL.

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.
 - 2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons..
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

3.3 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. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..
 - 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.

3.4 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.
 - 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 full lane width in drives and roads and in consecutive strips not less than 12 feet 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 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.

3.5 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.
 - 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 - 4. Perform work in a manner that allows each course within a section to be completed the day it is started.
 - 5. Perform work such that proper drainage (sheet) is maintained across all sections.
 - 6. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 - 7. Compact asphalt at joints to a density within 2 percent of specified course density.

3.6 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.
- 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: 92 percent of reference maximum theoretical density according to ASTM D 2041/D 2041M, 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.

3.7 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.
 - 2. Surface Course: Plus 1/4 inch, 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 straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Course: 1/8 inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.8 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 D 3549.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.
 - 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 D 2041, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - a. One core sample will be taken for every 1000 sq. yd. 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 D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- E. Replace and compact hot-mix asphalt where core tests were taken.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

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, including the following:
 - 1. Aprons.
 - 2. Curbs.
 - 3. Walks.
- B. Related Requirements:
 - 1. Section 033000 "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 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified ready-mix concrete manufacturer and testing agency.
- 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.

1.6 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 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").

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 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.

1.7 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, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F 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 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F 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 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 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 A 1064, fabricated from steel wire into flat sheets.
- B. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064, flat sheet.
- C. Reinforcing Bars: ASTM A 615, Grade 60; deformed.
- D. Epoxy-Coated Reinforcing Bars: ASTM A 775 or ASTM A 934; with ASTM A 615, Grade 60 deformed bars.
- E. Joint Dowel Bars: ASTM A 615, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.
- F. Tie Bars: ASTM A 615, Grade 60; deformed.
- G. Hook Bolts: ASTM A 307, Grade A, 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.

- H. 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.

2.4 CONCRETE MATERIALS

- A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
1. Portland Cement: ASTM C 150, gray, portland cement Type I, Type II or Type III.
 2. Fly Ash: ASTM C 618, Class C or Class F.
 3. Slag Cement: ASTM C 989, Grade 100 or 120.
 4. Blended Hydraulic Cement: ASTM C 595, Type IP, portland-pozzolan cement.
- B. Normal-Weight Aggregates: ASTM C 33, Class 4S, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.
1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Air-Entraining Admixture: ASTM C 260.
- 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 C 494, Type A.
 2. Retarding Admixture: ASTM C 494, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.
- E. Water: Potable and complying with ASTM C 94.

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. dry or cotton mats.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.

- D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
- E. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

2.6 RELATED MATERIALS

- A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.
- B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.7 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, 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: 20 percent.
 - 2. Slag Cement: 15 percent.
 - 3. Combined Fly Ash or Pozzolan, and Slag Cement: 20 percent, with fly ash or pozzolan not exceeding 15 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: 4-1/2 percent plus or minus 1 percent for 1-inch nominal maximum aggregate size.
 - 2. Air Content: 5 percent plus or minus 1 percent for 3/4-inch 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 plasticizing and retarding 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. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 4,000 psi.
2. Maximum W/C Ratio at Point of Placement: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94 and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. 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., increase mixing time by 15 seconds for each additional 1 cu. yd.
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 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.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch 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. 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 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. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
 5. 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 of 50 feet unless otherwise indicated.
 2. Extend joint fillers full width and depth of joint.
 3. Terminate joint filler not less than 1/2 inch or more than 1 inch 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:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes.

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 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 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 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 deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 DETECTABLE WARNING INSTALLATION

- A. Cast-in-Place Detectable Warning Tiles: Form blockouts in concrete for installation of tiles. Screed surface of concrete where tiles are to be installed to elevation, so that edges of installed tiles will be flush with surrounding concrete paving. Embed tiles in fresh concrete immediately after screeding concrete surface.

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 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.10 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
 - 1. Elevation: 1/2 inch.
 - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 - 3. Surface: Gap below 10-feet- long; unleveled straightedge not to exceed 1/4 inch.
 - 4. Joint Spacing: 3 inches (75 mm).
 - 5. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
 - 6. Joint Width: Plus 1/8 inch, no minus.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will 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 C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least one composite sample for each 50 cu. yd. 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 C 143; 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 C 231, 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 C 1064; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of five standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39; 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 the average of the two 28 day specimens exceeds the specified strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
1. If the average of two specimens is below a fourth cylinder from that set shall be broken and averaged with the previous 2.
 2. If the average of the three 28 day breaks does not meet strength requirements the final cylinder from that set shall be tested. If the average of the three highest compressive strength reports (lowest value discarded) meet specified strength the mixture will be considered adequate.
- 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 321373
CONCRETE PAVING 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. Cold-applied joint sealants.
 - 2. Joint-sealant backer materials.
 - 3. Primers.

1.3 ACTION SUBMITTALS

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

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.
 - 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 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, 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.

2.2 COLD-APPLIED JOINT SEALANTS

- A. Multicomponent, Nonsag, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
- B. Single Component, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.

2.3 JOINT-SEALANT BACKER MATERIALS

- A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

- D. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.4 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on 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.

3.3 INSTALLATION OF JOINT SEALANTS

- A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.
- C. Install joint-sealant backings to support joint 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 joint-sealant backings.
 - 2. Do not stretch, twist, puncture, or tear joint-sealant backings.
 - 3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:
 - 1. Place joint sealants so they fully contact joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements 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 joint sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING AND PROTECTION

- A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.
- B. 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 and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.5 PAVING-JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Joints within concrete paving.
1. Joint Location:
 - a. Expansion and isolation joints in concrete paving.
 - b. Contraction joints in concrete paving.
 - c. Other joints as indicated.
- B. Joint-Sealant Application: Joints within concrete paving and between concrete and asphalt paving.
1. Joint Location:
 - a. Joints between concrete and asphalt paving.
 - b. Joints between concrete curbs and asphalt paving.
 - c. Other joints as indicated.

END OF SECTION

**SECTION 321723
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.
 - 2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of n Michigan Department of Transportation 2020 Standard Specifications for Construction for pavement-marking work.

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 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design"

2.2 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: As indicated.
- B. Glass Beads: AASHTO M 247, Type 1 made of 100 percent recycled glass.
 - 1. Roundness: Minimum 75 percent true spheres by weight.

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 Engineer.
- B. Allow paving to age for a minimum of 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. 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 stencil. Apply paint so that it cannot run beneath stencil.
 - 2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.

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 321723

SECTION 329115

SOIL PREPARATION (PERFORMANCE SPECIFICATION)

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 and layered soil assemblies specified according to performance requirements 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 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 inter-laboratory 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.

1.4 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. Material Certificates: For each type of 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.

1.5 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.

PART 2 - PRODUCTS

2.1 PLANTING SOILS SPECIFIED ACCORDING TO PERFORMANCE REQUIREMENTS

- A. Planting-Soil Type Native Topsoil: Existing, on-site surface soil, with the duff layer, if any, retained; and stockpiled on-site; modified to produce viable planting soil. Using preconstruction soil analyses and materials specified in other articles of this Section, amend existing, on-site surface soil to become planting soil complying with the following requirements:
 - 1. Percentage of Organic Matter: Minimum 3 percent by volume.
 - 2. Soil Reaction: pH of 6 to 7.
- B. Planting-Soil Type Imported Topsoil: Imported, naturally formed soil from off-site sources and consisting of sandy loam soil according to USDA textures; and modified to produce viable planting soil. Amend imported soil with materials specified in other articles of this Section to become planting soil complying with the following requirements:
 - 1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches deep, not from bogs, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or obnoxious weeds and invasive plants including, but not limited to, quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and brome grass.
 - 2. Additional Properties of Imported Soil before Amending: Minimum of 4 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration. Clean soil to be of the following:

- a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
 - b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 2 percent by dry weight of the imported soil.
 - c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 1-1/2 inches in any dimension.
3. Percentage of Organic Matter: Minimum 3 percent by volume.
 4. Soil Reaction: pH of 6 to 7.

2.2 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 1. Class: T, with a minimum of 99 percent passing through a No. 8 sieve and a minimum of 75 percent passing through a No. 60 sieve.
 2. Form: Provide lime in form of ground dolomitic limestone.
- B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.
- E. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33.

2.3 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:
 1. Feedstock: May include sewage sludge or animal waste.
 2. Reaction: pH of 5.5 to 8
 3. USCC soluble-salt concentration requirement is less than 10 dS/m.
 4. Soluble-Salt Concentration: Less than 4 dS/m.
 5. Moisture Content: 35 to 55 percent by weight.
 6. Organic-Matter Content: 30 to 40 percent of dry weight.
 7. Particle Size: Minimum of 98 percent passing through a 1-inch sieve.
- B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 3.4 to 4.8, and a soluble-salt content measured by electrical conductivity of maximum 5 dS/m.
- C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 6 to 7.5, a soluble-salt content measured by electrical conductivity of maximum 5 dS/m, having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.

- D. Wood Derivatives: Shredded and composted, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
- E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.4 FERTILIZERS

- A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
- B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

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.
- C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

- A. Excavation: Excavate soil from designated area(s) to a depth as required and stockpile until amended.
- B. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
- C. Unsuitable Materials: Clean soil to contain a combined maximum of 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.
- D. Screening: Pass unamended soil through a 1-inch sieve to remove large materials.

3.3 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

- A. General: Apply and mix unamended 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. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply, add soil amendments, and mix approximately half the thickness of unamended soil over prepared, loosened subgrade according to "Mixing" Paragraph below. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil.
- C. Mixing: Spread unamended soil to total depth of 4 inches, but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. Amendments: Apply soil amendments, and fertilizer, if required, evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.
 - a. Mix lime with dry soil before mixing fertilizer.
 - b. Mix fertilizer with planting soil no more than seven days before planting.
 2. Lifts: Apply and mix unamended soil and amendments in lifts not exceeding 4 inches in loose depth for material compacted by hand-operated tampers.
- D. Compaction: Compact each blended lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698.
- E. 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.

3.4 PLACING MANUFACTURED PLANTING SOIL OVER EXPOSED SUBGRADE

- A. General: Apply manufactured soil on-site in its final, blended condition. 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. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
1. Apply approximately half the thickness of planting soil over prepared, loosened subgrade. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil.
- C. Application: Spread planting soil to total depth of 4 inches, but not less than required to meet finish grades after natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.
1. Lifts: Apply planting soil in lifts not exceeding 4 inches in loose depth for material compacted by hand-operated tampers.
- D. Compaction: Compact each lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698.
- E. 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.

3.5 PROTECTION

- 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. If planting soil or subgrade is over compacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Architect and replace contaminated planting soil with new planting soil.

3.6 CLEANING

- A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.
- B. 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

**SECTION 329200
TURF AND GRASSES**

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. Seeding.
 - 2. Hydroseeding.
 - 3. Sodding.
 - 4. Erosion-control material(s).
- B. Related Requirements:
 - 1. Section 329115 "Soil Preparation" for planting soil and layered soil assemblies.

1.3 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- D. 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 329115 "Soil Preparation (Performance Specification)" and drawing designations for planting soils.
- E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 INFORMATIONAL SUBMITTALS

- A. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

- B. Product Certificates: For fertilizers, from manufacturer.
- C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

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.
- C. 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. Accompany each delivery of bulk materials with appropriate certificates.

1.6 FIELD CONDITIONS

- A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion
 - 1. Spring Planting: May 1 to June 15.
 - 2. Fall Planting: September 1 to October 1.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species:
 - 1. Quality: Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:

2. Sun and Partial Shade: Proportioned by weight as follows:

- a. 20 percent Kentucky bluegrass (95/85).
- b. 20 percent creeping red fescue.
- c. 40 percent perennial ryegrass.
- d. 10 percent redtop.
- e. 10 percent Kenblue Kentucky bluegrass.

3. Shade: Proportioned by weight as follows:

- a. 35 percent creeping red fescue.
- b. 35 percent compass chewings fescue.
- c. 20 percent turf type perennial rye.
- d. 10 percent rough bluegrass.

4. Economy: Proportioned by weight as follows:

- a. 40 percent creeping red fescue.
- b. 20 percent perennial ryegrass.
- c. 30 percent annual rye.
- d. 10 percent Kentucky bluegrass.

2.2 TURFGRASS SOD

A. Turfgrass Sod: Approved Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.

B. Turfgrass Species: Sod of grass species as follows, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:

1. Full Sun: Kentucky bluegrass (*Poa pratensis*), a minimum of three cultivars.

2. Sun and Partial Shade: Proportioned by weight as follows:

- a. 50 percent Kentucky bluegrass (*Poa pratensis*).
- b. 30 percent chewings red fescue (*Festuca rubra* variety).
- c. 10 percent perennial ryegrass (*Lolium perenne*).
- d. 10 percent redtop (*Agrostis alba*).

3. Shade: Proportioned by weight as follows:

- a. 50 percent chewings red fescue (*Festuca rubra* variety).
- b. 35 percent rough bluegrass (*Poa trivialis*).
- c. 15 percent redtop (*Agrostis alba*).

2.3 FERTILIZERS

- A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
- B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

2.4 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
- C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.
- D. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.5 PESTICIDES

- A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.6 EROSION-CONTROL MATERIALS

- A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.
 - 1. 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 soil within a planting area.
 - 2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 3. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
 - 1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
 - 2. Protect grade stakes set by others until directed to remove them.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 329115 "Soil Preparation (Performance Specification)."
- B. Placing Planting Soil: Place and mix planting soil in place over exposed subgrade.
 - 1. Reduce elevation of planting soil to allow for soil thickness of sod.
- C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- D. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

- A. Prepare area as specified in "Turf Area Preparation" Article.

- B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.
- C. Fill cells of erosion-control mat with planting soil and compact before planting.
- D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
- E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.
 - 1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - 2. Do not use wet seed or seed that is moldy or otherwise damaged.
 - 3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate of 5 to 8 lb/1000 sq. ft.
- C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets installed and stapled according to manufacturer's written instructions.
- E. Protect seeded areas with erosion-control mats where indicated on Drawings; install and anchor according to manufacturer's written instructions.
- F. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
 - 1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
 - 2. Bond straw mulch by spraying with asphalt emulsion at a rate of 10 to 13 gal./1000 sq. ft.. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.
- G. Protect seeded areas from hot, dry weather or drying winds by applying water within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly and roll surface smooth.

3.6 HYDROSEEDING

- A. Hydroseeding: Mix specified seed, slow-release fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

3.7 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
 1. Lay sod across slopes exceeding 1:3.
 2. Anchor sod on slopes exceeding 1:6 with wood pegs spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.8 TURF MAINTENANCE

- A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the a height of 1 1/2 to 2 inches:

3.9 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Engineer:
 - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
 - 2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
- B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.10 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.11 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.
- C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- D. Remove non-degradable erosion-control measures after grass establishment period.

3.12 MAINTENANCE SERVICE

- A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:
 - 1. Seeded Turf: 60 days from date of planting completion.
 - a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.
 - 2. Sodded Turf: 30 days from date of planting completion.

END OF SECTION 329200

**SECTION 33 16 00
OIL/WATER SEPARATOR**

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Underground Tanks:
 - 1 Oil /Water Separators.

1.2 RELATED SECTIONS

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 22 1005 – Plumbing Piping

1.3 REFERENCES

- 1. IAPMO IGC 183-2016 certified and carry a UPC listing.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Submit manufacturer's data sheets on each product to be used, including, but not limited to, the following:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation manual and operating guidelines.
- C. Shop drawings: Tank manufacturer shall submit the following for review and approval prior to fabrication of the tanks:
 - 1. Detailed shop drawings of each tank complete with all accessories supplied by the manufacturer describing materials, dimensions, and attachments.
 - 2. Detailed shipping, handling and installation instructions.

1.5 QUALITY ASSURANCE

- A. Tank installations in the United States:
 - 1. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with tank manufacturer's Installation and Operating Guidelines recommendations for delivery, storage, and tank handling.

1.7 WARRANTY

- A. Warranty: Provide manufacturer's standard limited warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS:

- A. Contract Documents are based on the Striem OT-500 manufactured in Kansas City, Kansas.

- B. Substitutions: Approved Equal.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 OIL SEPARATORS

- A. Oil Separator
 - 1. Tank Design: Single-Wall HDPE vessel designed for underground installation and rated for 314 gpm as specified and shown on the drawings with a lifetime warranty made in the USA.
 - 2. Tank Accessories:
 - a. Separator Anchoring
 - 1) Anchor straps shall be as supplied by the manufacturer and designed for a maximum load of 25,000 lbs.
 - 2) Galvanized turnbuckles shall be supplied by the manufacturer.
 - 3) Prefabricated anchors for concrete installation shall be supplied by the manufacturer.
 - b. Manways:
 - 1) Field adjustable riser system with cast iron frames and lids rated for H-20 loading. Watertight with minimum 22 inches I.D. accessway and complete with gaskets, bolts and cover.
 - c. Fittings:
 - 1) All fittings shall be NPT half or full couplings, 6 inches in diameter.
 - 2) Fittings shall be installed on the separator-top centerline or in the cover of the manway.
 - 3) Duplex fittings shall be located on each side of the separator's centerline.
 - d. Sludge Baffle:
 - 1) All separators shall have coalescing media to limit effluent quality to less than 5 ppm oil content.
 - 2) Capacity shall be 285 gallons of oil and 162 gallons of sediment/sludge.
 - e. Oil Level Monitoring System:
 - 1) General:
 - a) All separators shall have an electronic liquid-level monitoring system, including a controller and a sensor.
 - 2) Materials:
 - a) The controller shall be NEMA 4X, fiberglass, weatherproof, corrosion-resistant enclosure.
 - 3) Requirements:
 - a) The controller shall have a remotely mounted audio-visual alarm activated by a float sensor.
 - b) The controller shall provide for automatic pump-out capability.

PART 3 EXECUTION

3.1 TESTING

- A. Tank shall be tested according to the tank manufacturer's Installation Manual and Operating Guidelines in effect at time of installation.

3.2 INSTALLATION

- A. Tank shall be installed according to the tank manufacturer's Installation Manual and Operating Guidelines in effect at time of installation.

END OF SECTION

**SECTION 333113
SITE SANITARY SEWERS**

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. PVC pipe and fittings.
 - 2. Nonpressure-type transition couplings.
 - 3. Cleanouts.
 - 4. Manholes.
 - 5. Concrete.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Pipe and fittings.
 - 2. Non-pressure couplings
 - 3. Cleanouts.
- B. Shop Drawings: For manholes. Include plans, elevations, sections, details, steps, boots, and frames and covers. Product data for all other items.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings:
- B. Field quality-control reports.

1.5 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 according to manufacturer's written rigging instructions.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Gravity Sewer Piping:

1. Pipe: ASTM D 3034, SDR 26, PVC sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

2.2 NONPRESSURE-TYPE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling; for joining underground non-pressure piping. Include ends of same sizes as piping to be joined and include corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2. For Concrete Pipes: ASTM C 443, rubber.
3. For Fiberglass Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
4. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
5. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.3 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches 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 minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 92, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, 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 intervals. Omit steps if total depth from floor of manhole to finished grade is less than 48 inches.
10. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required adjusting manhole frame and covering to indicated elevation and slope. Include sealant recommended by ring manufacturer.

11. Grade Rings: Reinforced-concrete rings, 6-inch to 9-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 7-inch to 9-inch riser, with 4-inch minimum-width flange and 26-inch-diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
2. Material: ASTM A 48, Class 35 gray iron unless otherwise indicated.

2.4 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 1064, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A, Grade 60 deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi 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: 2 percent through manhole.
2. Benches: Concrete, sloped to drain into channel.
 - a. Slope: 8 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A1064, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details to indicate general location and arrangement of underground sanitary sewer 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 according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings no greater than 45 degrees 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 micro tunneling.
- F. Install gravity-flow, non-pressure, drainage piping according to the following:
 - 1. Install PVC gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
- G. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, non-pressure, drainage piping according to the following:
 - 1. Join PVC gravity sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
 - 2. Join dissimilar pipe materials with non-pressure-type, flexible couplings.

3.4 MANHOLE INSTALLATION

- A. General: Install manholes complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Form continuous concrete channels and benches between inlets and outlet.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 2 inches above finished surface elsewhere unless otherwise indicated.

3.5 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.6 CONNECTIONS

- A. Connect non-pressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 221316 "Sanitary Waste and Vent Piping."
- B. 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 overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
 - 2. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.7 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate report 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 according to 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. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Test plastic gravity sewer piping according to ASTM F 1417.
 - 6. Manholes: Perform hydraulic test according to ASTM C 969.
- 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.

3.8 CLEANING

- A. Clean dirt and superfluous material from interior of piping and manholes.

END OF SECTION 331313

SECTION 02 4119
SELECTIVE DEMOLITION

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. Demolition and removal of selected portions of building or structure.
 - 2. Demolition and removal of selected site elements.
 - 3. Salvage of existing items to be reused or recycled.
- B. Related Requirements:
 - 1. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 FIELD CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- B. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
- D. Storage or sale of removed items or materials on-site is not permitted.

1.6 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

3.2 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.3 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
 - 1. Clean and repair items to functional condition adequate for intended reuse.
 - 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 - 3. Protect items from damage during transport and storage.
 - 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.4 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at

perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn demolished materials.

3.6 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 03 0516
UNDERSLAB VAPOR BARRIER

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sheet vapor barrier under concrete slabs on grade.

1.02 RELATED REQUIREMENTS

- A. Section 03 1000 - Concrete Forming and Accessories.
- B. Section 03 2000 - Concrete Reinforcing.
- C. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

- A. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.
- B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products.
- C. Samples: Submit samples of underslab vapor barrier to be used.
- D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Underslab Vapor Barrier:
 - 1. Water Vapor Permeance: Not more than 0.010 perms, maximum.
 - 2. Thickness: 15 mils.
 - 3. Basis of Design:
 - a. Stego Industries LLC; Stego Wrap Vapor Barrier (15-mil): www.stegoindustries.com.
- B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc., for sealing seams and penetrations in vapor barrier.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surface over which vapor barrier is to be installed is complete and ready before proceeding with installation of vapor barrier.

3.02 INSTALLATION

- A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.
- B. Install vapor barrier under interior slabs on grade; lap sheet over footings and seal to foundation walls.
- C. Lap joints minimum 6 inches.
- D. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.
- E. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.

- F. Repair damaged vapor retarder before covering with other materials.

END OF SECTION

SECTION 03 1000
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.
- B. Openings for other work.
- C. Form accessories.
- D. Form stripping.

1.02 RELATED REQUIREMENTS

- A. Section 03 2000 - Concrete Reinforcing.
- B. Section 03 3000 - Cast-in-Place Concrete.
- C. Section 05 1200 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-in-place concrete.

1.03 REFERENCE STANDARDS

- A. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- B. ACI 301 - Specifications for Structural Concrete; 2020.
- C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2019.
- D. ACI 347R - Guide to Formwork for Concrete; 2014, (Reapproved 2021).
- E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on void form materials and installation requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver prefabricated forms and installation instructions in manufacturer's packaging.
- B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

- A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work. Contractor's choice of materials that will provide smooth, stain-free final appearance.
- B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.
- C. Earth Cuts: Upon approval of the Architect-Engineer, side forms for footings may be of earth provided the soil will stand without caving and the sides of the bank are made with a neat cut to the minimum dimensions indicated on the drawings.
- D. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.
- E. Comply with relevant portions of ACI 347R, ACI 301, and ACI 318 and complying with tolerances of ACI 117.

2.02 WOOD FORM MATERIALS

- A. Form Materials: At the discretion of the Contractor.

2.03 REMOVABLE PREFABRICATED FORMS

- A. Manufacturers:
 - 1. Molded Fiber Glass Construction Products Co; www.mfgcp.com.
 - 2. S-Form; Aluminum Formwork Systems: www.s-form.us.
 - 3. SureVoid Products, Inc; www.surevoid.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Preformed Steel Forms: Minimum 16 gage, 0.0598 inch thick, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- C. Preformed Aluminum Forms: ASTM B221, 6061-T6 alloy, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- D. Preformed Plastic Forms: Thermoplastic polystyrene form liner, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- E. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.
- F. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 2 inches thick.

2.04 FORMWORK ACCESSORIES

- A. Form Ties: Removable type, galvanized metal, fixed length, cone type, with waterproofing washer, free of defects that could leave holes larger than 1 inch in concrete surface. Alternate: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.
- B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.
 - 1. Composition: Colorless reactive, mineral oil-based, soy-based, or vegetable-oil based compound.
 - 2. Do not use materials containing diesel oil or petroleum-based compounds.
 - 3. Products:
 - a. SpecChem, LLC; Bio Strip WB (water-based): www.specchemllc.com.
 - b. W. R. Meadows, Inc; Duogard: www.wrmeadows.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- C. Dowel Sleeves: Plastic sleeve and nailable plastic base for smooth, round, steel load-transfer dowels.
 - 1. Products:
 - a. BoMetals, Inc; www.bometals.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- E. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 1200.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

- A. At Contractor's option, upon approval of the Architect-Engineer, side forms for footings may be of earth provided the soil will stand without caving and the sides of the bank are made with a neat cut to the minimum dimensions indicated on the drawings. No top over pours are permitted.
- B. Make all necessary provisions to prevent cave-ins during placement of concrete.

3.03 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.
- F. Coordinate this section with other sections of work that require attachment of components to formwork.
- G. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

3.04 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items that will be cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.06 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
 - 1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
 - 2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.07 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

3.08 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.
- C. Do not reuse wood formwork more than two times for concrete surfaces to be exposed to view. Do not patch formwork.

3.09 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION

SECTION 03 2000
CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Reinforcing steel for cast-in-place concrete.
- B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

- A. Section 03 1000 - Concrete Forming and Accessories.
- B. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

- A. ACI 301 - Specifications for Structural Concrete; 2016.
- B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).
- C. ACI SP-66 - ACI Detailing Manual; 2004.
- D. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2018.
- E. ASTM A704 - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement; 2019, with Editorial Revision.
- F. ASTM A706 - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement; 2016.
- G. ASTM A767 - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2016.
- H. ASTM A996 - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement; 2016.
- I. ASTM A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2018a.
- J. ASTM D3963 - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars; 2015.
- K. AWS D1.4 - Structural Welding Code - Reinforcing Steel; 2018.
- L. CRSI (DA4) - Manual of Standard Practice; 2009.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements.
- B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
 - 1. Prepare shop drawings under seal of a Professional Structural Engineer experienced in design of work of this type and licensed in the State in which the Project is located.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301.
 - 1. Maintain one copy of each document on project site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Continuously Galvanized Reinforcing Steel:

1. AZZ, Inc; Galvabar; www.azz.com.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615, Grade 60 (60,000 psi).
 1. Deformed billet-steel bars.
- B. Reinforcing Steel: ASTM A706, deformed low-alloy steel bars.
 1. Unfinished.
- C. Reinforcing Steel: Deformed bars, ASTM A996 Grade 40 (280), Type A.
 1. Galvanized in accordance with ASTM A767, Class I.
- D. Reinforcing Steel Mat: ASTM A704, using ASTM A615, Grade 40 (40,000 psi) steel bars or rods, unfinished.
- E. Stirrup Steel: ASTM A1064 steel wire, unfinished.
- F. Steel Welded Wire Reinforcement (WWR): Galvanized, deformed type; ASTM A1064.
 1. Form: Flat Sheets, 4 feet X 8 feet
 2. WWR Style: 6 inch x 6 inch – W2.9 x W2.9.
- G. Reinforcement Accessories:
 1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.
 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
 3. Provide stainless steel components, galvanized or plastic coated steel for placement within 1-1/2 inches of weathering surfaces.

2.03 RE-BAR SPLICING:

- A. Coupler Systems: Mechanical devices for splicing reinforcing bars; capable of developing full steel reinforcing design strength in tension and compression.
 1. Products:
 - a. Dayton Superior Corporation; www.daytonsuperior.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. Dowel Bar Splicer with Dowel-Ins: Mechanical devices for connecting dowels; capable of developing full steel reinforcing design strength in tension and compression.
 1. Products:
 - a. Dayton Superior Corporation; www.daytonsuperior.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- C. Taper Tie Hole Plug: Mechanical device for plugging tie holes; anchors optional flush or recessed grout.
 1. Products:
 - a. Dayton Superior Corporation; www.daytonsuperior.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- D. Grout: Cementitious, non-metallic, non-shrink grout for use with manufacturer's grout sleeve reinforcing bar coupler system.
 1. Products:
 - a. Dayton Superior Corporation; www.daytonsuperior.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
- B. Welding of reinforcement is permitted only with the specific approval of Architect. Perform welding in accordance with AWS D1.4 .

1. Galvanized Reinforcement: Clean surfaces, weld and re-protect welded joint in accordance with CRSI (DA4).
- C. Fabricate and handle epoxy-coated reinforcing in accordance with ASTM D3963.
- D. Locate reinforcing splices not indicated on drawings at point of minimum stress.

PART 3 EXECUTION

3.01 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor barrier.
- C. Accommodate placement of formed openings.
- D. Maintain concrete cover around reinforcing as follows:
 1. Beams: 1 1/2 inch
 2. Supported Slabs and Joists: 3/4 inch.
 3. Column Ties: 1 1/2 inch.
 4. Walls (exposed to weather or backfill): 2 inch.
 5. Footings and Concrete Formed Against Earth: 3 inch.
 6. Slabs on Fill: 1 1/2 inch.
- E. Comply with applicable code for concrete cover over reinforcement.
- F. Bond and ground all reinforcement to requirements of Division 26.

3.02 FIELD QUALITY CONTROL

- A. An independent testing agency, as specified in Section 01 4000 - Quality Requirements, will inspect installed reinforcement for compliance with contract documents before concrete placement.

END OF SECTION

SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

- B. Floors and slabs on grade.
- C. Concrete foundations and anchor bolts for pre-engineered building.
- D. Joint devices associated with concrete work.
- E. Miscellaneous concrete elements, including bollard bases.
- F. Concrete curing.

1.02 RELATED REQUIREMENTS

- 1. Section 03 1000 – Concrete Forming and Accessories.
- 2. Section 03 2000 – Concrete Reinforcing.
- 3. Section 03 3006 – Waterproofing Admixture for Cast-In-Place Concrete
- 4. Section 07 9100 – Preformed Joint Seals
- 5. Section 07 9200 – Joint Sealants: sealants and joint fillers for saw cut joints and isolation joints in slabs.
- 6. Section 22 1426.19 – Facility Trench Drains

1.03 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
- B. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
- C. ACI 301 - Specifications for Structural Concrete.
- D. ACI 302.1R - Guide to Concrete Floor and Slab Construction.
- E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
- F. ACI 305R - Guide to Hot Weather Concreting.
- G. ACI 306R - Guide to Cold Weather Concreting.
- H. ACI 308R - Guide to External Curing of Concrete.
- I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
- J. ASTM C1602 - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
- K. ASTM C33 - Standard Specification for Concrete Aggregates.
- L. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- M. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
- N. ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens).
- O. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete.
- P. ASTM C150 - Standard Specification for Portland Cement.
- Q. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- R. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
- S. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.

- T. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
- U. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- V. ASTM C685 - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.
- W. ASTM C827 - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.
- X. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- Y. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
- Z. ASTM D471 - Standard Test Method for Rubber Property--Effect of Liquids.
- AA. ASTM D8139 - Standard Specification for Semi-Rigid, Closed-Cell Polypropylene Foam, Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.
- AB. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- AC. COE CRD-C 48 - Method of Test for Water Permeability of Concrete.
- AD. COE CRD-C 513 - COE Specifications for Rubber Waterstops.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
 - 1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
 - 2. For chemical-resistant waterstops, provide data on ASTM D471 test results.
- C. Mix Design: Submit proposed concrete mix designs for each specific application.
 - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
 - 2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.
- D. Samples: Submit samples of underslab vapor retarder to be used.
- E. Test Reports: Submit report for each test or series of tests specified.
- F. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
- G. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.
- D. Manufacturer Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI certified Flatwork Technician and Finisher and a supervisor who is an ACI Certified Concrete Flatwork Technician.
- E. Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.

- F. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 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.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Formwork Design and Construction: See Section 03 1000 – Concrete Forming and Accessories

2.02 REINFORCEMENT MATERIALS

- A. See Section 03 2000 – Concrete Reinforcing.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type II - Moderate or Type III - High Early Strength Portland type, for cold weather placement only.
 - 1. Acquire cement for entire project from same source.
- B. Fine and Coarse Aggregates: ASTM C33.
 - 1. Acquire aggregates for entire project from same source.
- C. Lightweight Aggregate: ASTM C330.
 - 1. Acquire aggregates for entire project from same source.
- D. Fly Ash: ASTM C618, Class C or FDo not use "fly ash" in concrete exposed to view.
- E. Calcined Pozzolan: ASTM C618, Class N.
- F. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.
- G. Slag Cement: ASTM C 989, Grade 100 or 120.
- H. Water: ASTM C1602; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Air Entrainment Admixture: ASTM C260.
- C. High Range Water Reducing and Retarding Admixture: ASTM C494 Type G.
- D. High Range Water Reducing Admixture: ASTM C494 Type F.
- E. Water Reducing and Accelerating Admixture: ASTM C494 Type E.
- F. See Section 03 3006 – Waterproofing Admixture for Cast-In-Place Concrete.

2.05 ACCESSORY MATERIALS

- A. Underslab Vapor Barrier: See Section 03 0516 – Underslab Vapor Barrier
- B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 - 1. Grout: Comply with ASTM C1107.
 - 2. Height Change, Plastic State; when tested in accordance with ASTM C827:
 - a. Maximum: Plus 4 percent.
 - b. Minimum: Plus 1 percent.

3. Minimum Compressive Strength at 28 Days: 2000 pounds per square inch.
4. Products containing aluminum powder are not permitted.
5. Flowable Products:
 - a. Kaufman Products Inc; SureGrout: www.kaufmanproducts.net.
 - b. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; DURAGROUT: www.laticrete.com/our-products/concrete-construction-chemicals.
 - c. SpecChem, LLC; SC Precision Grout: www.specchemllc.com.
 - d. W. R. Meadows, Inc; 588-10K: www.wrmeadows.com.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
6. Low-Slump, Dry Pack Products:
 - a. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; Duragrout: www.lmcc.com.
 - b. The QUIKRETE Companies; QUIKRETE® FastSet™ Non-Shrink Grout: www.quikrete.com.
 - c. SpecChem, LLC; SC Multipurpose Grout: www.specchemllc.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

2.06 JOINTING PRODUCTS

- A. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches on center; ribbed steel stakes for setting.
 1. Provide removable plastic cap strip that forms wedge-shaped joint for sealant installation.
 2. Height: To suit slab thickness.
 3. Manufacturers:
 - a. BoMetals, Inc: www.bometals.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. Expansion- and Isolation-Joint-Filler Strips:
 1. ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- C. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
 1. Material: ASTM D8139, semi-rigid, closed-cell polypropylene foam.
 2. Manufacturers:
 - a. Nomaco, Inc; Nomaflex Expansion Joint Filler with Void Cap Option: www.nomaco.com.
- D. Waterstops: Rubber, complying with COE CRD-C 513.
 1. Configuration: Flat or dumbbell type as indicated on drawings.
 2. Size: As indicated on drawings.
 3. Manufacturers:
 - a. The Burke Co..
 - b. Williams Products.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- E. Dowel Sleeves: Plastic sleeve for smooth, round, steel load-transfer dowels.
 1. Manufacturers:
 - a. BoMetals, Inc; QuicDowel: www.bometals.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- F. Supports for Reinforcement

Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications, unless otherwise acceptable. Wood, brick and other devices shall not be acceptable.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs. Concrete block or brick for support of reinforcement for slabs on grade shall be at least 2" wide, 3" long and of proper heights.

2.07 CURING MATERIALS

- A. Curing Compound not required with use of waterproofing admixture.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

2.08 CONCRETE MIX DESIGN

- A. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
 1. See Section 03 3006 – Waterproofing Admixture for Cast-In-Place Concrete.
- B. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- C. Normal Weight Concrete:
 1. Compressive Strength, when tested in accordance with ASTM C39 at 28 days: 4,000 pounds per square inch.
 2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight. Do not use fly ash in concrete exposed to view.
 3. Calcined Pozzolan Content: Maximum 10 percent of cementitious materials by weight.
 4. Silica Fume Content: Maximum 5 percent of cementitious materials by weight.
 5. Water-Cement Ratio: Maximum 40 percent by weight.
 6. Total Air Content: 5 percent +/- 1 percent for exterior concrete including walls, determined in accordance with ASTM C173 .
 7. Maximum Slump: 5 inches.
 8. Maximum Aggregate Size: 5/8 inch.
- E. Interior Slabs on Grade:
 1. Normal weight concrete.
 2. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
 3. Reinforcement: As indicated on the drawings.
- F. Exterior Slabs on Grade
 1. Normal weight concrete
 2. Air Content: As indicated for normal weight concrete
 3. Reinforcement: As indicated on the drawings

2.09 SLUMP LIMITS

- A. Ramps/slabs/slopes = 3 inches maximum.
- B. Reinforced foundation = 1 inch to 6 inches.
- C. MDWR/HDWR = 8 inches maximum. After admixture to verified 2 inch to 3 inch slump concrete.

2.10 MIXING

- A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
- B. Transit Mixers: Comply with ASTM C94.
- C. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.
- D. Do not change mix designs without the approval of the architect and testing agency.
- E. Do not retemper if concrete has set.

2.11 MIXING

- A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
- B. Transit Mixers: Comply with ASTM C94.
- C. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

- A. Verify that forms are clean and free of rust before applying release agent.
- B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
 - 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
 - 2. Use latex bonding agent only for non-load-bearing applications.
- D. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.
 - 1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings.

3.03 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- E. Notify Architect not less than 24 hours prior to commencement of placement operations.
- F. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

- G. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- H. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
- I. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.04 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 3. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where 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. Locate joints as indicated on drawings.
- F. Anchor joint fillers and devices to prevent movement during concrete placement.

3.05 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. Maximum Variation of Surface Flatness:
 - 1. Exposed Concrete Floors: 1/4 inch in 10 feet.
 - 2. Under Seamless Resilient Flooring: 1/4 inch in 10 feet.
 - 3. Under Carpeting: 1/4 inch in 10 feet.
- B. Correct the slab surface if tolerances are less than specified.
- C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.06 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
- C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
 - 1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
 - 2. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.
 - 3. Provide 3/4" chamfer at all exposed edges.
- D. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
 - 1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.
 - 2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
 - 3. Decorative Exposed Surfaces: Trowel as described in ACI 302.1R; take measures necessary to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, surfaces to receive liquid hardeners, surfaces to receive dry-shake hardeners, surfaces to be polished, and all other exposed slab surfaces.
- E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1/8" per foot nominal.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, aprons, walks, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

3.07 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in place construction. 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.

3.08 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 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, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.09 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- B. Inspections:
 - 1. Verification of use of required design mixture.
 - 2. Concrete placement, including conveying and depositing.
 - 3. Curing procedures and maintenance of curing temperature.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd, plus one set for each additional 50 cu. yd. or fraction thereof.
 - 2. Slump: ASTM C 143; 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 C 231, pressure method, for normal-weight concrete; 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 C 1064; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
 - 5. Compression Test Specimens: ASTM C 31.
 - a. Cast and laboratory cure one set of five standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39; test one laboratory-cured specimen at 7 days and two specimens at 28 days.
 - a. Should the average strength of the two specimens fall below the design strength a third 28 day specimen shall be tested. If average is still below the design strength the final specimen shall be tested.
7. Strength of each concrete mixture will be satisfactory if the 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.
8. Test results shall be reported in writing to Engineer, 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.
9. 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 Engineer..
10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
12. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
13. Slab Testing: Cooperate with manufacturer of specified moisture vapor reduction admixture (MVRA) to allow access for sampling and testing concrete for compliance with warranty requirements.
14. Moisture testing of concrete slabs per finish flooring manufacturer prior to installing finish floor. Test results must be within acceptable manufacturers limits.

3.10 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.11 PROTECTION

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 03 3006
WATERPROOFING ADMIXTURE FOR CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Waterproofing admixture for cast-in-place concrete.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

1.03 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete;
- B. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- C. Mix Design: Submit manufacturer approval of proposed concrete mix design.
- D. Material Certificate: Certify that products of this section meet or exceed specified requirements.
- E. Material Test Report: Document that products of this section comply with specified requirements.
- F. Field Quality Control Submittals: Include project name and number, date of admixture application, name of testing agency, location of concrete batch in work, mix proportions, materials, and test result.
- G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.
- B. Concrete Supplier Qualifications: Company certified by waterproofing admixture manufacturer with not less than three years of documented experience.
- C. Concrete Finisher Qualifications: Company certified by waterproofing admixture manufacturer with not less than three years of documented experience, and approved by manufacturer.
- D. Moisture Testing: By waterproofing admixture manufacturer's representative.
- E. For slabs required to have waterproofing admixture, do not proceed with placement unless manufacturer's representative is present for every day of placement.
- F. Obtain admixture from a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original, undamaged containers with labels intact.
- B. Comply with manufacturer's written handling instructions prior to mixing.
- C. Comply with manufacturer's written storage instructions.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

- B. Slabs with Waterproofing Admixture: Provide admixture manufacturer's ten year warranty against spalling and failure of waterproofing.

PART 2 PRODUCTS

2.01 WATER VAPOR REDUCING ADMIXTURE

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Waterproofing Admixture: Single component, liquid, inorganic admixture free of volatile organic compounds (VOCs); reacts with cementitious material to integrally and permanently close route of moisture transmission.
 - 1. Location: Provide admixture in all slabs.
 - 2. Location: Provide admixture in slabs as indicated on Drawings.
 - 3. Capillary Break: Calcium silicate hydrate.
 - 4. Water Vapor Permeance: 0.0017 perms, maximum, when tested in accordance with ASTM E96/E96M.
 - 5. Toxicity: None.
 - 6. Solvent: Water.
 - 7. Hazardous Vapors: None.
 - 8. Products:
 - a. Specialty Products Group; Vapor Lock 20/21: www.spggogreen.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CONCRETE MIX DESIGN

- A. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates required by manufacturer.
- B. Provide at all interior and exterior slabs on grade per Section 033000 - Cast-in-Place Concrete.

2.03 MIXING

- A. Mixers: See Section 03 3000.

PART 3 EXECUTION

3.01 PREPARATION

- A. Where new concrete with admixture is to be bonded to previously placed concrete, prepare surfaces according to admixture manufacturer's instructions.
- B. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.
 - 1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as shown on the drawings.

3.02 INSTALLATION

- A. Dispense admixture according to mix design and supplier's written instructions.
- B. Add admixture to concrete according to manufacturer's written instructions.
- C. Place and cure concrete as specified in Section 03 3000.

3.03 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000.
- B. Provide free access to concrete operations at project site and cooperate with appointed testing agency.

- C. Slab Testing: Cooperate with manufacturer of specified waterproofing admixture to allow access for sampling and testing concrete for compliance with warranty requirements.
- D. Maintain four concrete cylinders for one year from date of Substantial Completion.
- E. Test cylinders as required by admixture manufacturer.
- F. Demonstrate test cylinders comply with requirements specified in Part 2.
- G. Test one cylinder per project.
- H. Field Quality Control Reports:
 - 1. Submit test results to Architect, Contractor, and admixture manufacturer, within 48 hours of testing.
 - 2. Include project name, project number, date of admixture application, name of testing agency, location of concrete in the Work, concrete mix design, and waterproofing capability.

3.04 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 48 hours of test.
- B. Defective Concrete: Concrete not complying with specified requirements.
- C. When test results indicate concrete does not comply with specified requirements, conducts additional tests as directed by Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- D. Repair or replacement of defective concrete will be determined by the Architect.

END OF SECTION

SECTION 04 0511
MORTAR AND MASONRY GROUT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Mortar for masonry.
- B. Grout for masonry.

1.02 RELATED REQUIREMENTS

- A. Section 04 2000 - Unit Masonry
- B. Section 08 1113 - Hollow Metal Doors and Frames: Products and execution for grouting steel door frames installed in masonry.

1.03 REFERENCE STANDARDS

- A. ASTM C5 - Standard Specification for Quicklime for Structural Purposes.
- B. ASTM C91 - Standard Specification for Masonry Cement.
- C. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
- D. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
- E. ASTM C150 - Standard Specification for Portland Cement.
- F. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
- G. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
- H. ASTM C387 - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar.
- I. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
- J. ASTM C476 - Standard Specification for Grout for Masonry.
- K. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
- L. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete.
- M. ASTM C1019 - Standard Test Method for Sampling and Testing Grout.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.
- C. Manufacturer's Installation Instructions: Submit packaged dry mortar manufacturer's installation instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.06 FIELD CONDITIONS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

- A. At Contractor's option, mortar and grout may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only, or ready-mixed.
- B. Mortar Color: Natural gray unless otherwise indicated.
- C. Mortar Mix Designs: ASTM C270, Property Specification.
 - 1. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellant agents, anti-freeze components, or other admixtures, unless otherwise indicated.
 - a. Do not use calcium chloride in mortar or grout.
 - b. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement mortar cement and lime.
 - 2. Masonry below grade and in contact with earth: Type S.
 - 3. Exterior, Loadbearing Masonry: Type S.
 - 4. Exterior, Non-loadbearing Masonry: Type S.
 - 5. Interior, Loadbearing Masonry: Type S.
 - 6. Interior, Non-loadbearing Masonry: Type N.
- D. Grout Mix Designs:
 - 1. Bond Beams and Lintels: 3,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94.
 - 2. Engineered Masonry: 3,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94.

2.02 MATERIALS

- A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387 and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
 - 1. Type: Type S.
 - 2. Color: Standard gray.
 - 3. Water repellent mortar for use with water repellent masonry units.
- B. Portland Cement: ASTM C150.
 - 1. Type: Type I - Normal; ASTM C150.
 - 2. Color: Standard gray.
- C. Masonry Cement: ASTM C91.
 - 1. Type: Type N; ASTM C91.
- D. Hydrated Lime: ASTM C207, Type S.
- E. Quicklime: ASTM C5, non-hydraulic type.
- F. Mortar Aggregate: ASTM C144.
- G. Grout Aggregate: ASTM C404.
- H. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979.
 - 1. Color(s): As selected by Architect from manufacturer's full range.
 - 2. Manufacturers:
 - a. Davis Colors: www.daviscolors.com.
 - b. Lambert Corporation: www.lambertusa.com.
 - c. Solomon Colors; Solomon Colors Concentrated A, H, and X Series: www.solomoncolors.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- I. Water: Clean and potable.

2.03 MORTAR MIXING

- A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.
- B. Maintain sand uniformly damp immediately before the mixing process.
- C. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio; mix in accordance with manufacturer's instructions, uniform in coloration.
- D. Do not use anti-freeze compounds to lower the freezing point of mortar.
- E. If water is lost by evaporation, re-temper only within two hours of mixing.

2.04 MORTAR ADMIXTURES

- A. Water-Repellent Mortar Admixture: Mortar admixture complying with ASTM C1384, formulated by manufacturer to repel water, minimize efflorescence, and enhance mortar and concrete masonry unit bonding.
- B. Product: GCP Applied Technologies, (800) 558-7066, DRY-BLOCK Mortar Admixture.
- C. Substitutions: See Section 01 6000 - Product Requirements.
- D. Mix mortar incorporating water-repellent mortar admixture at manufacturer's recommended dosage rate and mixed according to manufacturer's written instructions.

2.05 GROUT MIXING

- A. Mix grout in accordance with ASTM C94.
- B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install mortar and grout to requirements of section(s) in which masonry is specified.
- B. Work grout into masonry cores and cavities to eliminate voids.
- C. Do not install grout in lifts greater than 16 inches without consolidating grout by rodding.
- D. Do not displace reinforcement while placing grout.
- E. Remove excess mortar from grout spaces.

3.02 GROUTING

- A. Use either high-lift or low-lift grouting techniques, at Contractor's option, subject to other limitations of Contract Documents.
- B. Low-Lift Grouting:
 - 1. Limit height of pours to 12 inches.
 - 2. Limit height of masonry to 16 inches above each pour.
 - 3. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
 - 4. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.
- C. High-Lift Grouting:
 - 1. Verify that horizontal and vertical reinforcement is in proper position and adequately secured before beginning pours.
 - 2. Place grout for spanning elements in single, continuous pour.

3.03 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field tests, in accordance with provisions of Section 01 4000 - Quality Requirements.
- B. Test and evaluate mortar in accordance with ASTM C780 procedures.
 - 1. Test with same frequency as specified for masonry units.
- C. Test and evaluate grout in accordance with ASTM C1019 procedures.
 - 1. Test with same frequency as specified for masonry units.

END OF SECTION

SECTION 04 2000
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete block.
- B. Mortar and grout.
- C. Reinforcement and anchorage.
- D. Flashings.
- E. Lintels.
- F. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 2000 - Concrete Reinforcing: Reinforcing steel for grouted masonry.
- B. Section 04 0511 - Mortar and Masonry Grout.
- C. Section 05 5000 - Metal Fabrications: Loose steel lintels.
- D. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

- A. ASTM A641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.
- B. ASTM A951 - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2016.
- C. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016a.
- D. ASTM C91 - Standard Specification for Masonry Cement; 2018.
- E. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2017.
- F. ASTM C140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2018a.
- G. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.
- H. ASTM C150 - Standard Specification for Portland Cement; 2018.
- I. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.
- J. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019.
- K. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.
- L. ASTM C476 - Standard Specification for Grout for Masonry; 2019.
- M. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2019.
- N. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength; 2019.
- O. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2018.
- P. ASTM C1714 - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry; 2016.
- Q. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.
- R. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units and masonry accessories.

1. Design Mixes: For each concrete mix. Include alternate mix designs including Dry-Block system products.
- C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.
 1. Include calculations or selections from the manufacturer's prescriptive design tables that indicate compliance with the applicable building code and project conditions.
 2. Include the design engineer's stamp or seal on each sheet of shop drawings.
- D. Samples: Submit four samples of decorative block units to illustrate color, texture, and extremes of color range.
- E. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
- F. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.
- G. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.

1.05 QUALITY ASSURANCE

- A. Codes & Standards
 1. Provide and erect all masonry materials in accordance with the applicable recommendations of the "Masonry Specifications" of the Concrete products Association of Michigan for concrete masonry, as modified by the requirements specified below.
 2. All masonry is to be in accordance with the latest Building Code requirements for masonry structures (ACI 530/ASCE5) and Specifications for Masonry Structures (ACI 530.1/ASCE6) and N.C.M.A. Specifications
- B. Fire Rated Masonry: Wherever a fire-resistance classification is shown or scheduled for masonry construction (4-hr, 3-hr, and similar designations), comply with the requirements for materials and installation established by governing authorities for the construction shown.
- C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
- D. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
- B. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting securely tied. If unit become wet, do not install until they are dry.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
 2. Load-Bearing Units: ASTM C90, normal weight.
 - a. Hollow block, as indicated.
 - b. Exposed Faces: Manufacturer's standard color and texture where indicated.
 - c. Basis of Design:
 - 1) Dry-Block; W.R. Grace & Co., Construction Products Division.
 - 2) Substitutions: See Section 01 6000 - Product Requirements.
 3. Non-Loadbearing Units: ASTM C129.
 - a. Hollow block, as indicated.

- b. Lightweight.
 - c. Basis of Design:
 - 1) Dry-Block; W.R. Grace & Co., Construction Products Division.
 - 2) Substitutions: See Section 01 6000 - Product Requirements.
- 4. Special Shapes:
 - a. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding and other special conditions.
 - b. Provide bullnose units for outside corners, unless otherwise indicated.
- 5. Units with Integral Water Repellent: Concrete block units as specified in this section with polymeric liquid admixture added to concrete masonry units at the time of manufacture.
 - a. Performance of Units with Integral Water Repellent:
 - 1) Water Permeance: When tested per ASTM E514 and for a minimum of 72 hours.
 - (a) No water visible on back of wall above flashing at the end of 24 hours.
 - (b) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.
 - (c) No more than 25 percent of wall area above flashing visibly damp at end of test.
 - 2) Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
 - 3) Compressive Strength: ASTM C1314; maximum 5 percent decrease.
 - 4) Drying Shrinkage: ASTM C1148; maximum 5 percent increase in shrinkage.
 - b. Use at all units, unless noted otherwise.
 - c. Use only in combination with mortar that also has integral water repellent admixture.
 - d. Use water repellent admixtures for masonry units and mortar by a single manufacturer.
 - e. Manufacturers:
 - 1) Basis of Design: Grace Construction Products: Dry-Block
 - 2) Addiment Incorporated: Block Plus W-10
 - 3) Master Builders Inc.: Rheopel.
 - 4) Krete HQ.
 - 5) Acme- Hardestry Co.-: ACME Shield.
 - 6) Substitutions: See Section 01 6000 - Product Requirements.
- 6. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from the specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.02 MORTAR AND GROUT MATERIALS

- A. Mortar and Grout: See Section 04 0511 – Mortar and Masonry Grout.

2.03 REINFORCEMENT AND ANCHORAGE

- A. Manufacturers:
 - 1. Blok-Lok Limited; www.blok-lok.com.
 - 2. Hohmann & Barnard, Inc; X-Seal Anchor: www.h-b.com.
 - 3. WIRE-BOND; www.wirebond.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Reinforcing Steel: ASTM A615, Grade 60 (60,000 psi), deformed billet bars; galvanized.
- C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- D. Single Wythe Joint Reinforcement: ASTM A951.
 - 1. Type: Truss or ladder.
 - 2. Material: ASTM A1064 steel wire, mill galvanized to ASTM A641, Class 3.
 - 3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

4. Use preformed "T"s and "L"s at corners and intersections.

2.04 ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
 1. Manufacturers:
 - a. Blok-Lok Limited; www.blok-lok.com.
 - b. Hohmann & Barnard, Inc; www.h-b.com.
 - c. WIRE-BOND; www.wirebond.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.
 1. Manufacturers:
 - a. Hohmann & Barnard, Inc; www.h-b.com.
 - b. WIRE-BOND; www.wirebond.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- C. Isolation Material: Shall be waterproof corrugated paper:
 1. Manufacturers:
 - a. Williams Products, Inc.; Column Box Board.
 - b. Boomer Co.; Column Wrap.
 - c. Granco Industries; Brak-Bond.
- D. Building Paper: ASTM D226, Type I ("No.15") asphalt felt.
- E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.05 LINTELS

- A. Masonry Lintels: Sized to fit flush with wall width. As indicated on the plans.

2.06 MORTAR AND GROUT MIXING

- A. See Section 04 0511 – Mortar and Masonry Grout.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

- A. Maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

3.04 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:

1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: 3/8 inch; Concave.

3.05 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar and mortar smears as work progresses.
- E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.
- F. Interlock intersections and external corners, except for units laid in stack bond.
- G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- I. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
- J. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
- K. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with grout.

3.06 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.
- E. Lap joint reinforcement ends minimum 6 inches.
- F. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches on center.
- G. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.
- H. Embed ties and anchors in mortar joint and extend into masonry unit a minimum of 1-1/2 inches with at least 5/8 inch mortar cover to the outside face of the anchor.

3.07 LINTELS

- A. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
 1. Openings to 42 inches: Place two, No. 3 reinforcing bars 1 inch from bottom web.
 2. Openings from 42 inches to 78 inches: Place two, No. 5 reinforcing bars 1 inch from bottom web.
 3. Openings over 78 inches: Reinforce openings as detailed.
 4. Do not splice reinforcing bars.
 5. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
 6. Place and consolidate grout fill without displacing reinforcing.

- 7. Allow masonry lintels to attain specified strength before removing temporary supports.
- C. Maintain minimum 8 inch bearing on each side of opening.

3.08 GROUTED COMPONENTS

- A. Reinforce bond beams w/ reinforcing as indicated on the drawing, 1 inch from bottom web.
- B. Lap splices minimum 24 bar diameters.
- C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- D. Place and consolidate grout fill without displacing reinforcing.
- E. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.09 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- C. Control joints shall be "Michigan Control Joint" as per Concrete Products Association of Michigan's Technical Data Sheet and specifications.
- D. Control Joint Seal for Michigan Control Joint: Polyvinyl chloride strip seal.
 - 1. Available Products: Williams Products, Inc.; Weathertight R
- E. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.
- F. Form expansion joint as detailed on drawings.

3.10 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.
- B. Verify openings/penetrations required for other work furnished under other sections.
- C. Install built-in items plumb, level, and true to line.
- D. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
 - 1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
- E. Do not build into masonry construction organic materials that are subject to deterioration.

3.11 TOLERANCES

- A. Install masonry within the site tolerances found in TMS 402/602.
- B. Maximum Variation from Alignment of Columns: 1/4 inch.
- C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- E. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- G. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.
- H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.12 CUTTING AND FITTING

- A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.13 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
- B. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140 for compliance with requirements of this specification.
- C. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.14 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

3.15 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 05 5000
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel and aluminum items.

1.03 REFERENCE STANDARDS

- A. ASTM A36 - Standard Specification for Carbon Structural Steel.
- B. ASTM A48 - Standard Specification for Gray Iron Castings.
- C. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- D. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- E. ASTM A283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
- F. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- G. ASTM D6386 Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
- H. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
- I. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").
- J. SSPC-SP 2 - Hand Tool Cleaning.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A36.
- B. Plates: ASTM A283.
- C. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- D. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

- A. Bollards: Galvanized steel pipe, concrete filled, crowned cap; prime paint finish.
 - 1. Size: 6 inch dia., 7 foot length w/ 4 foot exposed.

2.04 FINISHES - STEEL

- A. Prime paint steel items.
 - 1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123 requirements. Provide minimum 1.7 oz/sq ft galvanized coating.
- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123 requirements.
- G. Galvanized steel to be painted shall be prepared per ASTM D6386.

2.06 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

- A. Anchor concealed lintel assembly to in-place construction complying with manufacturer's written instructions and approved shop drawings.
- B. Remove temporary bracing or shoring after mortar has reached design compressive strength after 28 days minimum.
- C. Install items plumb and level, accurately fitted, free from distortion or defects.

END OF SECTION

SECTION 06 2000
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Finish carpentry items.
- B. Hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

- A. Section 09 9113 - Exterior Painting: Painting of finish carpentry items.
- B. Section 09 9123 - Interior Painting: Painting of finish carpentry items.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- B. ANSI A135.4 - American National Standard for Basic Hardboard.
- C. ANSI A208.1 - American National Standard for Particleboard.
- D. ASTM C1036 - Standard Specification for Flat Glass.
- E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
- F. PS 1 - Structural Plywood.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide manufacturer's product data, storage and handling instructions for factory-fabricated units.
 - 2. Provide instructions for attachment hardware and finish hardware.
- C. Manufacturer's Instructions: Provide manufacturer's installation instructions for factory-fabricated units.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-fabricated units to project site in original packages, containers or bundles bearing brand name and identification.
- B. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.
- C. Protect from moisture damage.
- D. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Interior Items:
 - 1. Doors and glazed lights.
 - 2. Door hardware,

2.02 FASTENINGS

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
- B. Adhesive for factory-fabricated units: Manufacturer's recommended adhesive for application.

2.03 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Lumber for Shimming and Blocking: Softwood lumber of pine species.
- C. Wood Filler: Solvent base, tinted to match surface finish color.
- D. Attachment Accessories: See Sections 08 7100 - Door Hardware.
- E. Interior Doors and Frames: See Sections 08 1113 -Hollow Metal Doors.

2.04 HARDWARE

- A. Hardware: Comply with BHMA A156.9.

2.05 FABRICATION

- A. Shop assemble work for delivery to site, permitting passage through building openings.
- B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.06 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

- A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure materials and components in place, plumb and level.
- C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.03 SITE APPLIED WOOD TREATMENT

- A. Apply preservative treatment in accordance with manufacturer's instructions.
- B. Brush apply one coats of preservative treatment on wood in contact with cementitious materials. Treat site-sawn cuts.
- C. Allow preservative to dry prior to erecting members.

3.04 PREPARATION FOR SITE FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

3.05 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at perimeter foundation wall and underside of floor slabs.
- B. Batt insulation in interior wall construction.
- C. Spray foam insulating sealant for filling perimeter window and door shim spaces and crevices in exterior wall.

1.02 RELATED REQUIREMENTS

- A. Section 07 2500 - Weather Barriers: Separate air barrier and vapor retarder materials.

1.03 REFERENCE STANDARDS

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
- B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
- F. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.
- G. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.05 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

1.0 QUALITY ASSURANCE

- A. Insulation shall be installed per manufacturer's recommendation. Upon request, a one year product and installation warranty will be issued by both the manufacturer and installer.
- B. Engage an experienced dealer/applicator who has been trained and licensed by the product manufacturer and which has not less than three years direct experience in the installation of the foam products used.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.
- B. Insulation at perimeter window and door shim spaces and crevices in exterior walls and roof: polyurethane foam.
- E. Insulation of the Pre-Engineered Metal Building shall be part of the PEMB package, to be supplied and installed by the PEMB contractor. See Section 07 2110 – PEMB Insulation..

2.02 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
 - 1. Type and Compressive Resistance: Type IV, 25 psi, minimum.
 - 2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 - 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 4. Type and Thermal Resistance, R-value: Type IV, 5.0 per 1 inch thickness at 75 degrees F mean temperature.
 - 5. Board Edges: Square.
 - 6. Thickness: R-20 minimum
 - 7. Manufacturers:
 - a. Dow Chemical Company; STYROFOAM HIGHLOAD 40: www.dowbuildingsolutions.com.
 - b. Kingspan Insulation LLC; GreenGuard XPS Type IV, 25 psi: www.kingspan.com.
 - c. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

2.03 SPRAY FOAM INSULATION

- A. Spray foam insulation is a one component, expanding, low pressure-build, flexible polyurethane foam formulated to air seal the gap around window and door frames and in small cavities. The foam expands to generate an effective seal and when applied will not distort or bow window and door frames.
- B. Spray Foam Insulation: One component polyurethane foam
 - 1. Flame Spread Index: 15 or less, in accordance with ASTM E84
 - 2. Smoke Spread Index: 20, in accordance with ASTM E84
 - 3. Manufacturers:
 - a. Dow Chemical Company; Great Stuff Pro; www.dowgreatstuff.com
 - b. Substitutions: See Section 01 6000 - Product Requirements

2.05 BATT INSULATION MATERIALS

- A. Glass Fiber Batt Insulation: See Section 07 2110 – PEMB Insulation.

2.06 ACCESSORIES

- A. Flashing Tape/Detail/Transition Membrane: Special reinforced film with high performance adhesive.
 - 1. Application: Along top edges, cuts, penetrations, all laps and seams, and window and door openings.
 - 2. Width: As required for application to wrap opening width.
 - 3. Primer: Tape manufacturer's recommended product.
 - 4. Manufacturers:
 - a. GCP Applied Technologies, Perm-A-Barrier: www.gcpat.com.
 - 1) Perma Barrier Detail Membrane
 - 2) Vycor Plus Flashing
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. Tape joints of rigid insulation in accordance with insulation manufacturers' instructions.
- C. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
 - 1. Length as required for thickness of insulation material and penetration of metal deck and substrates.
- D. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Adhere a 6 inches wide strip of underslab vapor barrier over construction, control, and expansion joints with double beads of adhesive each side of joint.
- B. Install boards as indicated on the drawings on foundation perimeter.
 - 1. Place boards to maximize adhesive contact.
 - 2. Install in running bond pattern.
 - 3. Butt edges and ends tightly to adjacent boards and to protrusions.
- C. Extend boards over expansion joints, unbonded to foundation on one side of joint.
- D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION UNDER CONCRETE SLABS

- A. Place insulation under slabs on grade after base for slab has been compacted.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.06 BATT INSTALLATION

- A. See Section 07 2110 – PEMB Insulation.

3.07 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.

3.08 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 2110
PEMB INSULATION SYSTEM

PART 1.0 – GENERAL

1.01 SECTION INCLUDES

- A. Insulation System of Pre-Engineered Metal Buildings - New Construction.

1.02 RELATED SECTIONS

- A. Section 07 2100 – Thermal Insulation
- B. Section 13 3419 – Metal Building Systems

1.03 REFERENCES

- A. ASTM C991 - Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings.
- B. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
- C. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. ASTM E 96 - Standard Test Method for Water Vapor Transmission of Materials in Sheet Form (Procedure A).
- E. NAIMA 202-96(R) (Rev. 2000) STANDARD For Flexible Fiber Glass Insulation to be Laminated for Use in Metal Buildings
- F. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- G. UL 723 - Test for Surface Burning Characteristics of Building Materials.

1.04 DESIGN REQUIREMENTS

- A. Insulation R-Value of R-30 + R-11 liner system (U=0.029) for installed roof system.
- B. Insulation R-Value of R-25 + R-16 double layer (U=0.043) for installed wall system.
- C. The installed roof and wall systems shall provide a continuous vapor barrier.

1.05 SUBMITTALS

- A. Submit under provisions of section 01 3000.
- B. Product Data: Provide manufacturer's data for each of the following including:
 - 1. Roof installation instructions
 - 2. Wall installation instructions
 - 3. Product data sheet
 - 4. Design considerations guide
- C. Shop Drawings: Provide shop drawings that indicate the following:
 - 1. Liner fabric layout
 - 2. Insulation Layout and cut list
 - 3. Customer and project information

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company must participate in the fabrication of fiberglass insulation systems used in metal building roof and wall systems and have a minimum of 5 years' experience in the industry.
- B. Installer Qualifications:
- C. Companies shall be familiar with the installation practices associated with banded liner systems.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products indoors or in a dry, covered area.
- B. Do not open products until ready to use.
- C. Protect products from potential construction site damage.
- D. Use care when opening products as pallets may shift during shipment.
- E. Banding has sharp edges. Wear cut proof gloves when handling.
- F. Wear safety glasses when unpacking materials.

1.08 PROJECT CONDITIONS

- A. For best results, do not install this system outside of the temperature, humidity, ventilation and environmental limits recommended by the manufacturer. Products should be kept covered and dry at temperatures less than 100°F prior to installation.

PART 2.0 – PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable manufacturer: Owens Corning: www.owenscorning.com

2.02 MATERIALS

- A. The Optiliner™ system consists of the following materials:
 - 1. Unfaced light density fiberglass metal building insulation in the one of the following product categories:
 - a. Owens Corning Certified R Metal Building Insulation
 - 1) Complies with ASTM C991 Type 1.
 - 2) Complies with NAIMA 202-96-REV 2000.
 - 3) Flame Spread Index <25 and Smoke Developed Index <50 when tested in accordance with ASTM E84, NFPA 255 and UL 723.
 - 4) Minimum 50% recycled content (20% post-consumer and 30% pre consumer).
 - 5) Thermal Resistance: Available R-Values = R10, R11, R13, R16, R19, R25 or R30.
 - 6) Unfaced.
- B. Liner/Vapor Barrier
 - 1. Fabric liner facing/vapor barrier composed of woven high density polyethylene coated on both sides with polyethylene. Complies with the following:
 - a. ASTM C1136, Types I through Type VI
 - 1) Type I-IV exception for dimensional stability (value is < 2.0%.)
 - b. Perm rating: ≤ 0.02 when tested in accordance with ASTM E 96 Procedure A.
 - c. Flame Spread Index < 25 and Smoke Developed Index < 50 when tested in accordance with ASTM E 84.
 - d. Color:
 - 1) White
 - 2. Vapor barrier adhesive. Complies with the following:
 - a. Application temperature 10°F to 110° F
 - 3. Double sided vapor barrier tape. Complies with the following:
 - a. Width 0.75"
 - b. Rubber based and free film
 - 4. Patch tape. Complies with the following:
 - a. Adhesive added to one side
 - b. Installation temperature from 10°F to 110°F
 - 5. Metal Banding/Straps. Complies with the following:
 - a. Coated steel
 - b. 1.0" wide
 - c. Structural Steel Grade 50 per ASTM C 653

- d. Exposed color to match vapor barrier
 - 1) White
 - e. Backing – gray
- 7. Thermal breaks
 - a. Closed cell polyethylene foam tape for wall applications. Complies with the following:
 - 1) 0.125" thick to 0.375" thick
 - 2) 3.0" wide
 - b. Thermal spacer blocks. Complies with the following:
 - 1) Extruded or expanded polystyrene
 - 2) Minimum width 3.0"
 - 3) Thickness 0.5" – 1.0"
- 8. Light gage steel fasteners
 - a. Zinc plated cold forged steel
 - b. Head color to match vapor barrier
 - 1) White
 - c. Contain rubber sealing washer
- 9. Heavy gage steel fasteners
 - a. Zinc plated cold forged steel
 - b. Head color to match vapor barrier
 - 1) White
 - c. Contain rubber sealing washer
- 10. Insulation Hangars
 - a. Insul-hold insulation hangars

PART 3.0 – EXECUTION

3.01 EXAMINATION

- A. Ensure that building structure including bracing and any concealed building systems are completed and approved before installing a roof or wall liner system.
- B. Contact the appropriate personnel to correct any unsatisfactory conditions before proceeding.

3.02 INSTALLATION – GENERAL

- A. Install liner system in accordance with appropriate Owens Corning wall installation instructions and job specific shop drawings.
- B. Avoid gaps, voids and any excess compression of the light density fiberglass insulation.
- C. Purlin and girt attachment surfaces should be clean and dry prior to attaching two-faced tape or sealing adhesive.
- D. Installed fiberglass insulation should fit snugly against purlin and girt walls in the cavity space.

3.03 CLEANING

- A. Clean dirt from vapor barrier fabric using a soft cloth with soap and water or non-abrasive household cleaner. Solvent-based cleaners and abrasive pads should be avoided.

3.04 SAFETY PRECAUTIONS

- A. Installation contractor must have a site-specific safety plan and comply with all OSHA applicable local rules and regulations when installing this system.
- B. Workers must use OSHA required fall protection when installing the banded liner system at
- C. Banding has sharp edges and cut proof gloves should be worn when handling.

END OF SECTION

SECTION 07 21 16
INSULATION LINER

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Insulation liner system for pre-engineered metal buildings – existing construction.

1.02 REFERENCES

- A. Materials shall meet the property requirements of one or more of the following specifications as applicable to the specific product or end use:
 - 1. American Society for Testing of Materials (ASTM):
 - a. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
 - b. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - c. ASTM E 96 - Standard Test Method for Water Vapor Transmission of Materials in Sheet Form (Procedure A).
 - 2. National Fire Protection Association (NFPA):
 - a. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
 - 3. Underwriters Laboratories (UL):
 - a. UL 723 - Test for Surface Burning Characteristics of Building Materials.

1.03 DESIGN REQUIREMENTS

- A. The installed roof and wall systems shall provide a continuous vapor barrier.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's data for each of the following including:
 - 1. Roof installation instructions
 - 2. Wall installation instructions
 - 3. Product data sheet

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Companies shall be familiar with the installation practices associated with liner systems.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products indoors or in a dry, covered area.
- B. Do not open products until ready to use.
- C. Protect products from potential construction site damage.

1.07 PROJECT CONDITIONS

- A. For best results, do not install this system outside of the temperature, humidity, ventilation and environmental limits recommended by the manufacturer. Products should be kept covered and dry at temperatures less than 100°F prior to installation.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Basis of Design: Owens Corning Insulating Systems, LLC, Toledo, OH 43659;
www.owenscorning.com.

2.02 MATERIALS

- A. Basis of Design: The OptiLiner® System, consists of the following materials:

1. Fabric liner facing/vapor barrier composed of woven high-density polyethylene coated on both sides with polyethylene. Complies with the following:
 - a. ASTM C1136, Types I through Type VI
 - a. Type I-IV exception for dimensional stability (value is < 2.0%.)
 - b. Perm rating: d 0.02 when tested in accordance with ASTM E 96 Procedure A.
 - c. Flame Spread Index < 25 and Smoke Developed Index < 50 when tested in accordance with ASTM E 84.
 - d. Color:
 - 1) White
2. Vapor barrier adhesive. Complies with the following:
 - a. Application temperature 10°F to 110° F
3. Double sided vapor barrier tape. Complies with the following:
 - a. Width 0.75"
 - b. Rubber based and free film
4. Patch tape. Complies with the following:
 - a. Adhesive added to one side
 - b. Installation temperature from 10°F to 110°F
 - c. 3" width

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this section will be installed. Verify that adjacent materials are dry and ready to receive liner.
- B. Provide written report listing conditions detrimental to performance of work in this section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install liner system in accordance with manufacturer's installation instructions and approved Shop Drawings.

3.3 CLEANING

- A. Clean dirt from vapor barrier fabric using a soft cloth with soap and water or non-abrasive household cleaner. Solvent-based cleaners and abrasive pads should be avoided.

3.4 SAFETY PRECAUTIONS

- A. Installation contractor must have a site-specific safety plan and comply with all OSHA applicable local rules and regulations when installing this system.
- B. Workers must use OSHA required fall protection when installing the liner system at heights (see OSHA regulations at 29 CFR 1926, Subpart M).

END OF SECTION

SECTION 07 4213
INTERIOR METAL LINER PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured metal panels for interior liner panels, with accessory components.

1.02 RELATED REQUIREMENTS

- A. Section 13 3419 – Metal Building Systems.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Store prefabricated material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.
- B. Prevent contact with materials that may cause discoloration or staining of products.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: American Building Company: Longspan III Panel; www.americanbuildings.com.
- B. Design intent is to match the liner panels installed in the existing maintenance building to which this project is an addition to.

2.02 MANUFACTURED METAL PANELS

- A. Interior Liner Panels:
 - 1. Profile: Vertical and Horizontal; style as indicated. Smooth finish.
 - 2. Side Seams: Lapped edges fitted with continuous gaskets.
 - 3. Material: G90 zinc coated (galvanized) steel sheet, 29 gage minimum thickness.
 - 4. Panel Width: 36 inch.
 - 5. Paint Color: As selected by Architect from manufacturer's standard line.
- B. Trim: Same material, thickness and finish as interior sheets; brake formed to required profiles.

2.03 ACCESSORIES

- A. Field Touch-up Paint: To match factory applied finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that framing members are ready to receive panels.

3.02 INSTALLATION

- A. Install panels on walls and ceiling in accordance with manufacturer's instructions.
- B. Fasten panels to structural supports; aligned, level, and plumb.
- C. Locate joints over supports.

3.03 TOLERANCES

- A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch.
- B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch.

3.04 CLEANING

- A. Remove protective material from panel surfaces.

END OF SECTION

SECTION 07 7123
MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pre-finished aluminum gutters and downspouts.

1.02 REFERENCE STANDARDS

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- B. SMACNA (ASMM) - Architectural Sheet Metal Manual.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Comply with applicable code for size and method of rain water discharge.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on prefabricated components.
- C. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.
- D. Samples: Submit two samples, 6 inch long illustrating component design, finish, color, and configuration.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.
- B. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Gutters and Downspouts:
 - 1. Basis of Design: Hickman Edge Systems; Commercial Box Gutter: www.hickmanedgesystems.com.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Pre-Finished Aluminum Sheet: ASTM B209; 0.032 inch thick.
 - 1. Finish: Plain, shop pre-coated with kynar coating.
 - 2. Color: As selected from manufacturer's standard colors.

2.03 COMPONENTS

- A. Gutters: Profile as indicated. Size to meet code required rainfall requirements.
- B. Downspouts: Profile as indicated. Size to meet code required rainfall requirements.
- C. Anchors and Supports: Profiled to suit gutters and downspouts.
 - 1. Anchoring Devices: In accordance with CDA requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Brackets.

2.04 FABRICATION

- A. Form gutters and downspouts of profiles and size indicated.
- B. Fabricate with required connection pieces.

- C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints. Seal weathertight.
- D. Hem exposed edges of metal.
- E. Fabricate gutter and downspout accessories; seal watertight.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that surfaces are ready to receive work.

3.02 INSTALLATION

- A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.
- B. Slope gutters 1/4 inch per foot.

END OF SECTION

SECTION 07 7253
SNO GUARDS

PART 1 - GENERAL

1.01 SUMMARY:

- A. WORK INCLUDES:
 - 1. Gem Clamp™ and MEC Bracket for standing seam metal roof systems.
 - 2. Non-penetrating attachment directly to the roof panel seam.
 - 3. Provide brackets, clamps, set screws, fasteners and all other component parts that make up the snow retention system.
- B. RELATED SECTIONS:
 - 1. Section 13 3419: Metal Building Systems

1.02 SYSTEM DESCRIPTION:

- A. COMPONENTS:
 - 1. MEC Bracket
 - 2. 1" Gem Clamp™
 - 3. 1" x 1" Square Tubing
 - 4. End Cap
 - 5. Insert
 - 6. Ball Point Set Screw (Silver Bullet™)
 - 7. Barricade Plate™
- B. DESIGN REQUIREMENTS:
 - 1. Bracket/clamp spacing to be recommended by an Architect and/or Engineer.
 - 2. Spacing will vary based on several factors including geographical region, snow load and building characteristics.
 - 3. Install a minimum of 2 fasteners per bracket.

1.03 SUBMITTAL:

- A. REVIEW OF SUBMITTALS:
 - 1. Show locations of the snow retention system on the roof plan and specify bracket/clamp spacing as required by an Architect and/or Engineer.
 - 2. Include detailed product cut sheets, installation instructions and specifications.

1.04 QUALITY ASSURANCE:

- A. CERTIFICATION:
 - 1. Sno Gem® strongly recommends that these products be installed by a qualified Roofing Contractor who will have the knowledge and ability to properly install the product.
 - 2. Install the snow retention system in accordance with an approved layout, installation instructions and approved submittals.

1.05 DELIVERY / STORAGE / HANDLING:

- A. PROCEDURE:
 - 1. Inspect material upon delivery and provide notice of any missing or defective items within 24 hours.
 - 2. Adequately secure and protect the material until installation.

PART 2 - PRODUCTS

2.01 MANUFACTURER:

- A. GEM SERIES:
 - 1. A division of Sno Gem, Inc., 4800 Metalmaster Way, McHenry, IL 60050, (888) 766-4367, www.snogem.com.

2.02 MATERIALS:

A. COMPONENTS:

1. MEC Bracket: Stainless Steel.
2. 1" Gem Clamp™: 6061-T6 or 6063-T6 Aluminum.
3. 1" x 1" Square Tubing: 6061-T6 Aluminum or Stainless Steel.
4. Insert: Zinc Zamak #3.
5. End Cap: Zinc Zamak #3.
6. Silver Bullet™: 300 Series Stainless Steel.
7. Barricade Plate™: Aluminum or Stainless Steel.
8. Fastener: To be compatible with the specified roof application.

2.03 FINISH:

A. MATERIALS:

1. Standard mill finish.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. SUBSTRATE:

1. Inspect the roof system in its entirety to verify proper attachment, completion and the ability of the building structure to withstand additional loading applied by the snow retention system.

3.02 INSTALLATION:

A. PROCEDURE:

1. Install the snow retention system in accordance with an approved layout, installation instructions and approved submittals.

SECTION 07 8400
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping systems.
- B. Firestopping of joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.03 REFERENCE STANDARDS

- A. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops.
- B. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- C. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

1.05 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Firestopping Manufacturers:
 - 1. 3M Fire Protection Products; Fire Barrier FIP 1: www.3m.com/firestop.
 - 2. Hilti, Inc; FS-One Max: www.us.hilti.com.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Firestopping Materials: Any materials meeting requirements.
- B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Head-of-Wall Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.

2.04 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

- A. Blank Openings:
 - 1. In Walls:
 - a. 2 Hour Construction: UL System C-AJ-0090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
- B. Penetrations Through Walls By:
 - 1. Multiple Penetrations in Large Openings:

- a. 2 Hour Construction: UL System C-AJ-8143; Hilti FS-ONE MAX Intumescent Firestop Sealant.
- 2. Uninsulated Metallic Pipe, Conduit, and Tubing:
 - a. 2 Hour Construction: UL System C-AJ-1226; Hilti FS-ONE MAX Intumescent Firestop Sealant.
- 3. Insulated Pipes:
 - a. 2 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE IMAX intumescent Firestop Sealant.
- 4. Electrical Cables Not In Conduit:
 - a. 2 Hour Construction: UL System C-AJ-3095; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.06 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements including mineral wool.
 - 1. Fire Ratings: See drawings for required systems and ratings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174, and ASTM E2393.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

- A. Protect adjacent surfaces from damage by material installation

END OF SECTION

SECTION 07 9100
PREFORMED JOINT SEALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Precompressed foam seals.
- B. Compression gaskets.
- C. Preformed strip seals.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Liquid and mastic joint sealants and their backing materials.

1.03 REFERENCE STANDARDS

- A. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
- B. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness.
- C. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's technical data sheets for each product, including chemical composition, movement capability, color availability, limitations on application, and installation instructions.

1.05 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a two year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealers that fail to achieve watertight seal or exhibit loss of adhesion or cohesion.

PART 2 PRODUCTS

2.01 PRECOMPRESSED FOAM SEALS

- A. Precompressed Foam Seal: Comprised of urethane, modified-acrylic impregnated, or open-cell polyurethane foam impregnated with water-repellent, and with self-adhesive faces protected prior to installation by release paper.
 - 1. Color: Black.
 - 2. Size as required to provide water-tight seal when installed.
 - 3. Calculate size according to manufacturer's recommendations.

2.02 COMPRESSION GASKETS

- A. Compression Gasket: Extruded hollow polychloroprene (neoprene) gasket complying with ASTM D2628; not requiring blockout recess in substrate; not requiring vacuum to collapse seal for installation.
 - 1. Color: Black.
 - 2. Durometer Hardness, Type A: Within 55 to 65, when tested in accordance with ASTM D2240.
 - 3. Calculate size in accordance with manufacturer's recommendations.
 - 4. Applications:
 - a. Exterior wall expansion joints.

2.03 PREFORMED STRIP SEALS

- A. Preformed Strip Seal: Factory formed profile for adhered application to face of joint substrate.
 - 1. Measure size of existing joints before selecting seal width.
 - 2. Provide compatible materials for application as recommended by manufacturer.
 - 3. Applications:
 - a. Exterior wall expansion joints.
 - b. Door and window perimeter joints.
 - 4. Manufacturers:
 - a. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html.
 - b. Tremco Commercial Sealants & Waterproofing; www.tremcosealants.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

- A. Adhesive: As recommended by seal manufacturer.
- B. Substrate Cleaner: Non-corrosive, non-staining type recommended by seal manufacturer; compatible with joint forming materials.
- C. Primer: Type recommended by seal manufacturer to suit application; non-staining.
- D. Backing Tape: Self-adhesive polyethylene tape with surface that seal will not adhere to.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive this work.
- B. Measure joint dimensions and verify that seal products are of the correct size to properly seal the joints.

3.02 PREPARATION

- A. Properly prepare construction components adjacent to the work of this section to prevent damage and disfigurement due to this work.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's written instructions.
- B. Precompressed Foam Seals:
 - 1. Install only when ambient temperature is within recommended application temperature range of adhesive. Consult manufacturer when installing outside this temperature range.
 - 2. Prepare joints and install seals in accordance with manufacturer's written recommendations.
 - 3. Remove loose materials and foreign matter that could impair adhesion of sealant.
 - 4. Do not stretch precompressed seal; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.
- C. Compression Gaskets:
 - 1. Install only when ambient temperature is within recommended application temperature range of adhesive. Consult manufacturer when installing outside this temperature range.
 - 2. Prepare joints and install seals in accordance with manufacturer's written recommendations.
 - 3. Remove loose materials and foreign matter that could impair adhesion of sealant.
 - 4. Avoid joints except at ends, corners, and intersections; seal joints with adhesive; install with face 1/8 to 1/4 inch below adjoining surface.
- D. Preformed Strip Seals:
 - 1. Install when ambient temperature is within recommended application temperature range of adhesive, and consult with manufacturer before installing outside this temperature range.

2. Prepare joints and install seals in accordance with manufacturer's written recommendations.
3. Remove loose materials and foreign matter that could impair adhesion.
4. When installing over existing non-functioning sealant, remove portions of existing installation that protrude beyond surface; install backing tape on surface of existing sealant installation to prevent adhesion of strip seal.

3.04 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION

- A. Protect joints from damage until adhesives have properly cured.

END OF SECTION

**SECTION 07 9200
JOINT SEALANTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-sag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 9100 - Preformed Joint Seals
- B. Section 08 7100 - Door Hardware: Setting exterior door thresholds in sealant.
- C. Section 08 8000 - Glazing: Glazing sealants and accessories.

1.03 REFERENCE STANDARDS

- A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- B. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- C. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants.
- D. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used that includes the following.
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
 - 5. Substrates for which use of primer is required.
 - 6. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
 - 7. Sample product warranty.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection by Architect.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.

- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
 - 1. Bostik Inc: www.bostik-us.com.
 - 2. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html.
 - 3. Franklin International, Inc: www.titebond.com.
 - 4. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
 - 1. Bostik Inc; www.bostik-us.com.
 - 2. Dow Chemical Company; consumer.dow.com/en-us/industry/ind-building-construction.html.
 - 3. Tremco Commercial Sealants & Waterproofing; www.tremcosealants.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles.
 - e. Other joints indicated below.
 - 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. Other joints indicated below.
 - 3. Do not seal the following types of joints.
 - a. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - b. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - c. Joints where installation of sealant is specified in another section.
 - d. Joints between suspended panel ceilings/grid and walls.
- B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
 - 1. Type I - Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
 - 2. Type II - Lap Joints between Manufactured Metal Panels: Butyl rubber, non-curing.
 - 3. Type III - Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.
- C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
 - 1. Type I - Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
 - 2. Type II - Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.

3. Type III - Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.
 4. Type IV - Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
 5. Type V - Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.
- D. Interior Wet Areas: Wash Bays, bathrooms, restrooms, and kitchens; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.
- E. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining acrylic acoustical sealant complying with ASTM C 834.
1. Manufacturers that provide products meeting the requirements of this section include, but are not limited to, the following:
 - a. Basis of Design: Hilti, Inc.; CP 506; www.hilti.com.
 2. Colors of Exposed Acoustical Joint Sealants: White.

2.03 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.⁶ⁱ
1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O Open Cell Polyurethane.
 2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type C - Closed Cell Polyethylene.
 3. Open Cell: 40 to 50 percent larger in diameter than joint width.
 4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
 5. Manufacturers:
 - a. ADFAST Corporation; ADSEAL BR-2600 (Backer Rod): www.adfastcorp.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- D. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

- B. Perform installation in accordance with ASTM C1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.
- D. Install bond breaker backing tape where backer rod cannot be used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 FIELD QUALITY CONTROL

- A. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

3.05 POST-OCCUPANCY

- A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION

**SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Fire-rated hollow metal doors and frames.
- C. Thermally insulated hollow metal doors with frames.
- D. Accessories, including glazing, louvers, and matching panels.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware.
- B. Section 09 9113 - Exterior Painting: Field painting.
- C. Section 09 9123 - Interior Painting: Field painting.
- D. Section 08 8000 - Glazing

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2011.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2011.
- E. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2019a.
- F. ASTM A1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable 2018.
- G. ASTM A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- H. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.
- I. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- J. ITS (DIR) - Directory of Listed Products current edition.
- K. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2007.
- L. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.
- M. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2019.
- N. NFPA 105 – Standard for Smoke Door Assemblies and Other Opening Protectives 2022.
- O. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2017.
- P. NFPA 257 – Standard on Fire Test for Window and Glass Block Assemblies 2022.
- Q. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2013.
- R. UL (DIR) - Online Certifications Directory Current Edition.
- S. UL 9 – Standard for Safety Fire Tests of Window Assemblies 2009.
- T. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies 2016, Including All Revisions.

- U. UL 263 – Standard for Safety of Fire Tests of Building Construction Materials.
- V. UL 1784 – Standard for Air Leakage Tests of Door Assemblies and Other Opening Protectives 2015.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Ceco Door, an Assa Abloy Group: www.assaabloydss.com.
 - 2. Curries, an Assa Abloy Group: www.assaabloydss.com.
 - 3. Fleming Door Products, an Assa Abloy Group: www.assaabloydss.com.
 - 4. Republic Doors, an Allegion brand: www.republicdoor.com.
 - 5. Steelcraft, an Allegion brand: www.allegion.com.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653, cold-rolled steel complying with ASTM A1008, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A101, commercial steel (CS) Type B, for each.
 - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 3. Door Top Closures: Flush end closure channel, with top and door faces aligned.
 - 4. Door Edge Profile: Manufacturers standard for application indicated.
 - 5. Typical Door Face Sheets: Flush.
 - 6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
 - 7. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) by the hot-dip process in accordance with ASTM A653, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
- B. Type 1, Exterior Doors: Thermally insulated.
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).

- a. Level 2 - Heavy-duty.
 - b. Physical Performance Level B, 500 000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.
 - e. Zinc Coating: A60 galvanized coating; ASTM A653.
- 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
- 3. Door Thickness: 1-3/4 inch, nominal.
- 4. Door Face Sheets: Flush.
- 5. Weatherstripping: Refer to Section 08 7100.
- C. Type 2 , Interior Doors, Non-Fire-Rated:
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 2 - Heavy-duty.
 - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.
 - e. Zinc Coating: A60 galvanized coating; ASTM A653.
 - 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
 - 3. Door Thickness: 1-3/4 inch, nominal.
 - 4. Door Face Sheets: Flush.
- D. Type 3 ,Fire-Rated Doors:
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 2 - Heavy-duty.
 - b. Physical Performance Level B, 500 000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.
 - e. Zinc Coating: A60 galvanized coating; ASTM A653.
 - 2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
 - 3. Provide units listed and labeled by UL (DIR).
 - a. Attach fire rating label to each fire rated unit.
 - 4. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
 - 5. Door Thickness: 1-3/4 inch, nominal.
 - 6. Door Face Sheets: Flush.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Exterior Door Frames: Full profile/continuously welded type.
 - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvanized) in accordance with ASTM A653, with A60 coating.
 - 2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
 - 3. Weatherstripping: Separate, see Section 08 7100.
- D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
 - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvanized) in accordance with ASTM A653, with A60 coating.
 - 2. Frame Metal Thickness: 16 gage, 0.053 inch minimum.
- E. Door Frames, Fire-Rated: Full profile/continuously welded type.
 - 1. Fire Rating: Same as door, labeled.
 - 2. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvanized) in accordance with ASTM A653, with A60 coating.

- 3. Frame Metal Thickness: 16 gage, 0.053 inch minimum.
- F. Mullions for Pairs of Doors: None
- G. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- H. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch high to fill opening without cutting masonry units.
- I. Frames Wider Than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.
 - 1. Color: Color as selected by Architect from manufacturer's standard line.

2.06 ACCESSORIES

- A. Door Window Frames: Door window frames with glazing securely fastened within door opening.
 - 1. Size: As indicated on drawings.
 - 2. Frame Material: 18 gage, 0.0478 inch, galvanized steel.
 - 3. Metal Finish: Match door finish.
 - 4. Glazing: 1/4 inch thick, tempered glass, in compliance with requirements of authorities having jurisdiction.
- B. Glazing: insulated, laminated safety glazing, factory installed. Refer to Section 08 8000 for additional information.
- C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- D. Astragals and Edges for Double Doors: Pairs of door astragals, and door edge sealing and protection devices.
 - 1. UL listed products in compliance with requirements of authorities having jurisdiction.
 - 2. Provide surface mounted astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.
- E. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.
- F. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- G. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.

- C. Coordinate frame anchor placement with wall construction. All anchors to be concealed.
- D. Comply with glazing installation requirements of Section 08 8000.
- E. Install door hardware as specified in Section 08 7100.
- F. Coordinate installation of electrical connections to electrical hardware items.
- G. Touch up damaged factory finishes.
- H. Door Bottom Fit:
 - 1. 3/4 inch where no threshold or carpet.
 - 2. 1/8 inch with threshold or carpet.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.

3.06 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 3300
ROLLING FIRE DOORS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: electric operated, automatic closing, overhead rolling fire doors.
- B. Related Sections:
 - 1. 04 2000—Unit Masonry
 - 3. 08 7100—Door Hardware
 - 4. 09 9123—Interior Painting.
 - 5. Division 26. Electrical wiring and conduit, fuses, disconnect switches, connection of operator to power supply, installation of control station and wiring.

1.02 SYSTEM DESCRIPTION

- A. Performance Requirements:
 - 1. Provide doors with Underwriters' Laboratories, Inc. label for the fire rating classification, 1 1/2 hr.

1.03 REFERENCE STANDARDS

- A. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- C. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2000, with Errata (2008).
- D. NEMA MG 1 - Motors and Generators 2018.

1.04 SUBMITTALS

- A. Reference Section 01 33 00—Submittal Procedures; submit the following items:
 - 1. Product Data.
 - 2. Shop Drawings: Include special conditions not detailed in Product Data. Show interface with adjacent work.
 - 3. Quality Assurance/Control Submittals:
 - a. Provide manufacturer's installation instructions.
 - 4. Closeout Submittals:
 - a. Operation and Maintenance Manual.
 - b. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.
- C. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose specified.

1.06 DELIVERY STORAGE AND HANDLING

- A. Follow manufacturer's instructions.

1.07 WARRANTY

- A. Standard Warranty: Two years from date of shipment against defects in material and workmanship.
- B. Maintenance: Submit for owner's consideration and acceptance of a maintenance service agreement for installed products.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Manufacturer: Clopay Building Products Co., 8585 Duke Blvd., Mason, OH 45040-3101.
- B. Model: ERD10
- C. Substitutions: Reference Section 01 2500 Product Substitution Procedures.

2.02 MATERIALS

- A. Curtain:
 - 1. Slats: No. 5F, flat faced 22 gauge, Grade 40 steel, ASTM A 653 galvanized steel zinc coating.
 - 2. Bottom Bar: Two 2x2x1/8 inch structural steel angles.
 - 3. Fabricate interlocking continuous slat sections with high strength steel endlocks secured with two 1/4" rivets per UL requirements.
 - 4. Slat Finish:
 - a. GalvaNex™ Coating System and phosphate treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range; minimum 2.5 mils cured film thickness; ASTM D-3363 pencil hardness: H or better.
- B. Guides: Fabricate with minimum 3/16 inch structural steel. Top of inner and outer guide angles to be flared outwards to form bellmouth for smooth entry of curtain into guides. Provide removable guide stoppers to prevent over travel of curtain and bottom bar. Top 16 1/2" of coil side guide angles to be removable for ease of curtain installation and as needed for future curtain service.
 - 1. Finish:
 - a. Steel: ASTM A 123, Grade 85 zinc coating, hot-dip galvanized after fabrication.
- C. Counterbalance Shaft Assembly:
 - 1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot of width.
 - 2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs. Provide wheel for applying and adjusting spring torque.
- D. Brackets: Fabricate from minimum 1/4 inch steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.
 - 1. Finish:
 - a. ASTM A 123, Grade 85 zinc coating, hot-dip galvanized after fabrication.
- E. Hood: 24 gauge galvanized steel with reinforced top and bottom edges. Provide minimum 1/4 inch steel intermediate support brackets as required to prevent excessive sag.
 - 1. Finish:
 - a. GalvaNex™ Coating System and phosphate treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range; minimum 2.5 mils cured film thickness; ASTM D-3363 pencil hardness: H or better.

2.03 ACCESSORIES

- A. Photoelectric Smoke/Heat Detector: UL listed.
- B. Fire Emergency Annunciator: Provide ADA compliant horn/strobe fire emergency annunciator to give advanced warning that the fire door is about to close. Warning signal to activate upon alarm signal.
- C. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
 - a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.
 - b. Safety Edge: Located at bottom of sectional door panel, full width; electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object; hollow cover to provide weatherstrip seal.

2.04 OPERATION

- A. Motor Operated: Model FS, UL listed and FM approved, NEMA 1 enclosure rating, horsepower as recommended by manufacturer, 208/230v three phase service. Provide open drip-proof motor, removable without affecting setting of limit switches; UL listed thermal overload protection; solenoid brake; planetary reduction gearing and rotary limit switches; transformer with 24 v control secondary; and all integral electrical components prewired to terminal blocks.
 - 1. Automatic closure shall be activated by a local smoke/fire detector. Doors shall not require a releasing device when activated by an alarm signal.
 - 2. Doors shall maintain an average closing speed of not more than 9" per second during automatic closing. When automatic closure is activated, electric sensing edge and push button are inoperable.
 - 3. Doors shall be fail-safe and close upon power failure.
 - 4. Resetting of spring tension or mechanical dropouts shall not be required. Upon restoration of power, replacement of fusible link or clearing of the alarm signal, doors shall immediately reset by opening with the push button.
 - 5. The electrical contractor shall mount the control station(s) and supply the appropriate disconnect switch, all conduit and wiring per the overhead door wiring instructions.
 - a. Control Station: Surface mounted, "Open/Close/Stop" push buttons; NEMA 1.
- B. Automatic Closing and Speed Governor Mechanism:
 - 1. Motor Operated System:
 - a. Activation: Local smoke and heat detectors.
 - b. Operation: Motor operator shall close door upon signal from [central alarm system] [local smoke and heat detectors], power outage or melting of fusible link.
 - c. Closing Speed: Not more than 9 inches per second.
 - d. Reset Procedure: Operation of control station after alarm is cleared or power is restored or replace fusible link; resetting of spring tension or mechanical dropouts shall not be required.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings.
- B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.
- C. Commencement of work by installer is acceptance of substrate.

3.02 INSTALLATION

- A. General: Install door and operating equipment with necessary hardware, anchors, inserts, hangers and supports.
- B. Comply with NFPA 80 and follow manufacturer's installation instructions.

3.03 ADJUSTING

- A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion.

3.04 FIELD QUALITY CONTROL

- A. Site Test: Test doors for normal operation and automatic closing. Coordinate with authorities having jurisdiction to witness test and sign Drop Test Form.

3.05 CLEANING

- A. Clean surfaces soiled by work as recommended by manufacturer.
- B. Remove surplus materials and debris from the site.

3.06 DEMONSTRATION

- A. Demonstrate proper operation, testing and reset procedures to Owner's Representative.
- B. Instruct Owner's Representative in maintenance procedures.

END OF SECTION

SECTION 08 3613
SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Overhead sectional doors, electrically operated.
- B. Operating hardware and supports.
- C. Electrical controls.

1.02 RELATED REQUIREMENTS

- A. Section 13 3419 - Metal Building Systems.

1.03 REFERENCE STANDARDS

- A. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2019a.
- B. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- C. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- D. DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors; 2011.
- E. NEMA MG 1 - Motors and Generators; 2017.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- C. Product Data: Show component construction, anchorage method, and hardware.
- D. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.
- E. Operation Data: Include normal operation, troubleshooting, and adjusting.
- F. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.
- G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for electric motor and transmission.
- D. Provide five year manufacturer warranty for electric operating equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Clopay Building Products; Model 3718: www.clopaycommercial.com.
- B. Other Acceptable Manufacturers - Sectional Doors:
 - 1. Overhead Door Corporation: www.overheaddoor.com.
 - 2. Raynor Garage Doors: www.raynor.com.
 - 3. Wayne-Dalton: www.wayne-dalton.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STEEL DOORS

- A. Steel Doors: Flush steel, insulated; standard lift operating style with track and hardware; complying with DASMA 102, Commercial application.
 - 1. Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330, using 10 second duration of maximum load.
 - 2. Door Nominal Thickness: 1-3/4 inches thick.
 - 3. Exterior Finish: Color Blast two-part paint system; color as selected by Architect from manufacturer's standard line.
 - 4. Interior Finish: Standard White
 - 5. Glazed Lights: Four units, one row; set in place with resilient glazing channel.
 - 6. Electric Operation: Electric control station.
- B. Door Panels: Steel construction; outer steel sheet of 27 gage, flush profile; inner steel sheet of 27 gage, flat profile; Intellicore polyurethane insulation (R-16.2).
- C. Window Frame: Manufacturers standard, finish to match.
- D. Glazing: Insulated tempered glass units; clear; 26 inch wide x 13 inch high.

2.03 COMPONENTS

- A. Track: Rolled galvanized steel, 0.090 inch minimum thickness; 3 inch wide, continuous one piece per side; galvanized steel mounting brackets.
- B. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.
- C. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.
- D. Head Weatherstripping: EPDM rubber seal, one piece full length.
- E. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.

2.04 MATERIALS

- A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.
- B. Float Glass: Provide float glass glazing, unless noted otherwise.
 - 1. Heat-Strengthened and Fully Tempered Types: ASTM C1048.
- C. Insulation: Foamed-in-place polyurethane, bonded to facing.

2.05 ELECTRIC OPERATION

- A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
 - 1. Provide interlock switches on motor operated units.
 - 2. Basis of Design: LiftMaster; H (Logic 5.0) Hoist Operator; www.LiftMaster.com.
- B. Electric Operators:
 - 1. Mounting: Side mounted.
 - 2. Motor Enclosure:
 - a. Exterior Overhead Sectional Doors: NEMA MG 1, Type 1; open drip proof.

3. Motor Rating: 3/4 HP; standard duty, up to 25 cycles per hour.
 4. Motor Voltage: 208/230 volts, three phase, 60 Hz.
 5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
 6. Controller Enclosure: NEMA 1 type electrical box; heavy-duty 11-gauge steel frame with powder coat finish.
 7. Opening Speed: 8-9 inches per second.
 8. Brake: Manufacturer's standard type, activated by motor controller.
 9. Manual override in case of power failure or emergency.
 10. See Division 26 for electrical connections.
- C. Control Station: Provide standard three button (Open-Close-Stop) momentary-contact control device for each operator complying with UL 325.
1. 24 volt circuit.
 2. Surface mounted, at interior door jamb.
 3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
 - a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.
 - b. Safety Edge: Located at bottom of sectional door panel, full width; electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object; hollow cover to provide weatherstrip seal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
- B. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Anchor assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align door assembly including hardware.
- E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.
- F. Install enclosure and perimeter trim.

3.03 ADJUSTING

- A. Adjust door assembly for smooth operation and full contact with weatherstripping.

3.04 CLEANING

- A. Clean doors and frames and glazing.
- B. Remove temporary labels and visible markings.

3.05 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.
- B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

SECTION 08 5113
ALUMINUM WINDOWS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Aluminum windows for renovation work.

1.02 RELATED WORK

- A. Section 07 9200 - JOINT SEALANTS

1.03 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American Architectural Manufacturers Associations (AAMA):
 - 1. AAMA/WDMA/CSA 101/I.S.2/A440-17 Windows, Doors, and Skylights.
 - 2. AAMA 505-17- Dry Shrinkage and Composite Performance Thermal Cycle Test Procedures.
 - 3. AAMA 2605-20- Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
 - 4. AAMA TIR A8-16- Structural Performance of Composite Thermal Barrier Framing System.
- C. ASTM International (ASTM):
 - 1. B209-14- .Aluminum and Aluminum-Alloy Sheet and Plate.
 - 3. B221-14- Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 4. E283-19- Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - 5. E331-00(2016)- Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

1.04 PREINSTALLATION MEETINGS

- A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.
 - 1. Required Participants:
 - a. Architect/Engineer.
 - b. Owner
 - c. Contractor.
 - d. Installer.
 - 2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
 - a. Installation schedule.
 - b. Installation sequence.
 - c. Preparatory work.
 - d. Protection before, during, and after installation.
 - e. Installation.
 - f. Transitions and connections to other work.
 - g. Other items affecting successful completion.
 - 3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.05 SUBMITTAL

- A. Submittal Drawings:
 - 1. Indicate window types required for project.
 - 2. Identify window unit components by name and type of metal or material, show construction, locking systems, mechanical operators, trim, installation and anchorages.

3. Include glazing details and standards for factory glazed units.
- B. Manufacturer's Literature and Data:
 1. Description of each product.
 2. Installation instructions.
 3. Warranty.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 1. Regularly manufactures specified products.
 2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
- B. Provide contact names and addresses for completed projects when requested by Contracting Officer's Representative.
- C. Quality Certified Labels or Certificates:
 1. AAMA Label affixed to each window indicating compliance with specification.
 2. Certificates in lieu of label with copy of test report maximum 4 years old from independent testing laboratory and certificate signed by window manufacturer stating that windows provided comply with specified requirements and AAMA/WDMA/CSA 101/I.S.2/A440 for type of window specified.

1.07 STORAGE AND HANDLING

- A. Protect windows from damage during handling and construction operations before, during and after installation.
- B. Store windows under cover, setting upright.
- C. Do not stack windows flat.
- D. Do not lay building materials or equipment on windows.

1.08 WARRANTY

- A. Manufacturer's Standard Warranty: Warrant windows against material and manufacturing defects.

PART 2 - PRODUCTS

2.01 SYSTEM PERFORMANCE

- A. Design windows complying with specified performance:
 1. Load Resistance: ASCE/SEI 7.
 - a. Performance Grade: AAMA/WDMA/CSA 101/I.S.2/A440 required to resist maximum positive and negative wind load.
 2. Water Resistance: ASTM E331.
 3. Air Infiltration Resistance: ASTM E283.
- B. Provide the following operation types (verify location in field).
 1. Casement Windows:
 - a. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440, minimum CW-30.
 2. Single Sash Horizontal Sliding Windows:
 - a. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440, minimum CW-30.
 3. Fixed Windows:
 - a. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440, minimum CW-30.

2.02 MATERIALS

- A. Aluminum Extrusions: ASTM B221M (ASTM B221); 6063 alloy, T5 temper.
- B. Aluminum Sheet: ASTM B209M (ASTM B209); 5005 alloy, H15 or H34 temper.

2.03 PRODUCTS - GENERAL

- A. Provide windows from one manufacturer.

2.04 ALUMINUM WINDOWS

- A. Frames and Sashes: Aluminum extrusions, AAMA/WDMA/CSA 101/I.S.2/A440.
- B. Thermal-Break Window Construction:
 - 1. Manufacturer's Standard.
 - 2. Low conductance thermal barrier.
 - 3. Capable of structurally holding sash in position and together.
 - 4. Thermal Break Assemblies: Tested according to AAMA TIR A8 and AAMA 505.
 - 5. Design location of thermal break so that, in closed position, outside air does not come in direct contact with interior frame of window.
- C. Mullions: Match window units.
- D. Provide anchors and other related accessories required for installation.

2.05 GLAZING

- A. Glass and Glazing: As specified in Section 08 80 00, GLAZING.
 - 1. Factory glaze windows.
 - 2. Weep holes through glazed areas are not acceptable.

2.05 INSECT SCREENING

- A. Screen Mesh: 18 by 18, AAMA/WDMA/CSA 101/I.S.2/A440.
 - 1. Screen Cloth: Vinyl clad aluminum.
- B. Frame: Aluminum, match window unit finish type and color, unless otherwise indicated.

2.06 HARDWARE

- A. Locks: Two position locking bolts or cam type tamperproof custodial locks with a single point control located not higher than 60 inches from floor level. Locate locking devices in vent side rail. Provide concealed or non-removable fastenings for locks and keepers. Provide cam type locks on sliding units to pull window sashes together in a locked and secured position.
- B. Fabricate hinges of noncorrosive metal. Hinges may be fully concealed when window is closed. Surface mounted hinges are not acceptable.
- C. Weather Stripping: AAMA/WDMA/CSA 101/I.S.2/A440; leaf type weather-stripping is not acceptable.
- D. Provide wrenches, keys, or removable locking operating handles, as specified to operate windows.

2.07 FABRICATION

- A. Fabricate windows to comply specified performance class and grade.
 - 1. Assemble frame and sash so fasteners are concealed when window is closed.
 - 2. Attach locking and hold-open devices to windows with concealed fasteners.
 - 3. Where extrusion wall thickness is less than 3 mm (0.125 inch) thick, provide backup plates or similar reinforcements for fasteners.
 - 4. Use stainless steel fasteners to secure Venetian blind hanger clips, vent guide blocks, friction adjuster, and limit opening device.
- B. Aluminum Trim:
 - 1. Trim includes casings, closures, and panning.
 - 2. Fabricate to shapes shown, minimum 1.6 mm (0.062 inch) thick.
 - 3. Extruded or formed sections, straight, true, and smooth on exposed surfaces.
 - 4. Exposed external corners mitered and internal corners coped; fitted with hairline joints.

5. Reinforce 1.6 mm (0.062 inch) thick members with minimum 3 mm (1/8 inch) thick aluminum.
 6. Except for strap anchors, provide reinforcing for fastening near ends and spaced maximum 300 mm (12 inches) on center.
 7. Design to allow unrestricted expansion and contraction of members and window frames.
 8. Secure to window frames with machine screws or expansion rivets.
 9. Exposed screws, fasteners or pop rivets are not acceptable on exterior of casing or trim cover system.
- C. Aluminum Subsills and Stools:
1. Fabricate to shapes shown, minimum 2 mm (0.080 inch) thick extrusion.
 2. One piece full length of opening with concealed anchors.
 3. Sills turned up back edge minimum 6 mm (1/4 inch). Front edge provide with drip.
 4. Sill back edge behind face of window frame. Do not extend to interior surface or bridge thermal breaks.
 5. Do not perforate for anchorage, clip screws, or other requirements.

2.08 FINISHES

- A. Finish window units according to NAAMM AMP 500 series.
- B. Anodized Aluminum:
1. Color: Bronze
- C. Hardware: Finish hardware exposed when window is in closed position to match window.

2.09 ACCESSORIES

- A. Fasteners: AAMA/WDMA/CSA 101/I.S.2/A440; non-magnetic stainless steel.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Examine and verify substrate suitability for product installation.
1. Verify openings are within acceptable tolerances.
- B. Protect existing construction and completed work from damage.
1. Coordinate with demolition for replacement window projects for removal.
- C. Remove existing windows to permit new installation when replacement window is available, and ready for immediate installation.
1. Remove existing work carefully; avoid damage to existing work indicated to remain.
 2. Perform other operations as necessary to prepare openings for proper installation and operation of new windows.
 3. Do not leave openings uncovered at end of working day, during precipitation or temperatures below 60 degrees F.

3.02 INSTALLATION, GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
- B. Where type, size or spacing of fastenings for securing window accessories or equipment to building construction is not shown or specified, provide expansion or toggle bolts or screws, as best suited to construction material.
1. Sized and spaced to resist tensile and shear loads imposed.
 2. Do not install exposed fasteners on exterior, except when unavoidable for application of hardware.
 3. Provide non-magnetic stainless steel Phillips flat-head machine screws for exposed fasteners, where required, or special tamper-proof fasteners.
 4. Locate fasteners to avoid disturbing window thermal break.
- C. Set windows plumb, level, true, and in alignment; without warp or rack of frames or sash.
- D. Anchor windows on four sides with anchor clips or fin trim.

1. Do not allow anchor clips to bridge thermal breaks.
 2. Use separate clips for both sides of thermal breaks.
 3. Make connections to allow for thermal and other movements.
 4. Do not allow building load to bear on windows.
 5. Use manufacturer's standard clips at corners and maximum 600 mm (24 inches) on center.
 6. Where fin trim anchorage is indicated build into adjacent construction, anchoring at corners and maximum 600 mm (24 inches) on center.
- E. Sills and Stools:
1. Set in bed of mortar or other compound to fully support, true to line shown.
 2. Do not extend sill to inside window surface or past thermal break.
 3. Leave space for sealants at ends and to window frame unless indicated otherwise.

3.03 MULLIONS CLOSURES, TRIM, AND PANNING

- A. Cut mullions full height of opening and anchor directly to window frame on both sides.
- B. Closures, Trim, and Panning: External corners mitered and internal corners coped, fitted with hairline, tightly closed joints.
- C. Seal units following installation to provide weathertight system. .

3.05 CLEANING

- A. Lubricate hardware and moving parts.
- B. Remove excess glazing and sealant compounds.
- C. Clean exposed aluminum and glass surfaces. Remove contaminants and stains.
- D. Keep windows locked except while adjusting and testing.

END OF SECTION

SECTION 08710
FINISH HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included:
 - 1. Furnish hardware required to complete the work as shown on the drawings and as specified herein;
 - 2. Furnish trim attachments and fastenings, specified or otherwise required, for proper and complete installation.
 - 3. Furnish all items of Finish Hardware specified, scheduled, shown or required herein except those items specifically excluded from this section of the specification.
 - 4. These documents supersede all previous hardware specifications and shall be followed without substitution.
- B. Related work:
 - 1. Division 1 – General Requirements
 - 2. Division 6– Finish Carpentry: Installation of Finish Hardware
 - 3. Division 8 – Steel Doors and Frames
- C. Specific Omissions: Hardware for the following is specified or indicated elsewhere, unless specifically listed in the hardware sets:
 - 1. Overhead and Coiling doors

1.02 REFERENCES

- A. National Fire Protection Associations (NFPA):
 - 1. NFPA 101-2015, "Life Safety Code"
 - 2. NFPA 80-2013, "Installation of Fire Doors and Windows"
- B. Michigan Building Code -2015
- C. American National Standards Institute (ANSI):
 - 1. ANSI A 156 Standards series.
 - 2. ICC/ANSI A117.1-2015 Accessible and Usable Buildings and Facilities.

1.03 DEFINITIONS

- A. "Finish Hardware": Items required for swinging, sliding and folding doors, except special types of unique and non-matching hardware specified under door and frame Sections of these Specifications.

1.04 SYSTEM DESCRIPTION

- A. Design requirements:
 - 1. Review of hardware requirements:
 - a. Thoroughly review finish hardware schedule, comparing it with the floor plan, door schedule, and door details to verify hardware requirements, quantities, door swings, finishes, and sizes.
 - b. If an inconsistency or error in the proposed construction documents is suspected, the hardware supplier is to bring it immediately to the attention of the Architect. If the quantity of items is questioned, for bidding purposes, assume the higher quantity is required and price accordingly.
 - c. Architect's review of Submittals is for design concept only, and does not relieve the Contractor of the responsibility to furnish sufficient material and functions required for a complete and code-worthy installation. Determination of all quantities is the responsibility of the Contractor.
- B. Performance requirements:
 - 1. Furnish finish hardware complying with the requirements of laws, codes, ordinances and guidelines of governmental authorities having jurisdiction:
 - a. NFPA 101, "Life Safety Code", 2015 edition
 - b. NFPA 80, "Installation of Fire Doors and Windows", 2018 edition

- c. Michigan Building Code -2015
- d. ICC/ANSI A117.1-2015 Accessible and Usable Buildings and Facilities

1.05 SUBMITTALS:

- A. Hardware Schedule
 - 1. Submit number of Hardware Schedules as directed in Division 1.
 - 2. Follow guidelines established in Door & Hardware Institute Handbook (DHI) Sequence and Format for the Hardware Schedule unless noted otherwise.
 - 3. Schedule will include the following:
 - a. Door Index including opening numbers and the assigned Finish Hardware set.
 - b. Preface sheet listing category only and manufacturer's names of items being furnished as follows:

CATEGORY	SPECIFIED	SCHEDULED
Hinges	Manufacturer A	Manufacturer B
Lock sets	Manufacturer X	Manufacturer X
Kick Plates	Open	Manufacturer Z

- c. Hardware Locations: Refer to DHI Article 3.1 B.2 Locations.
 - d. Opening Description: Single or pair, number, room locations, hand, active leaf, degree of swing, size, door material, frame material, and UL listing.
 - e. Hardware Description: Quantity, category, product number, fasteners, and finish.
 - f. Headings that refer to the specified Hardware Set Numbers.
 - g. Scheduling Sequence shown in Hardware Sets.
 - h. Product data of each hardware item, and shop drawings where required, for special conditions and specialty hardware.
 - i. Electrified Hardware system operation description.
 - j. "Vertical" scheduling format only. "Horizontal" schedules will be returned "Not Approved."
 - k. Typed Copy.
 - l. Double-Spacing.
 - m. 8 1/2 x 11 inch sheets
 - n. U.S. Standard Finish symbols or BHMA Finish symbols.
- B. Product Data:
 - 1. Submit, in booklet form Manufacturers Catalog cut sheets of scheduled hardware.
 - 2. Submit product data with hardware schedule.
- C. Samples:
 - 1. Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware; if requested by the architect; submit one sample, if required, of each type of exposed hardware unit, finished as required and tagged with full description for coordination with schedule.
 - 2. Samples will be returned to the supplier. Units, which are acceptable and remain undamaged through submittal, review and field comparison procedures, may, after final check of operation, be used in the work, within limitations of keying coordination requirements.
- D. Submit to General Contractor/Construction Manager, the factory order acknowledgement numbers for the various hardware items to be used on the project. The factory order acknowledgement numbers shall help to facilitate and expedite any service that may be required on a particular hardware item. General Contractor/Construction Manager shall keep these order acknowledgement numbers on file in the construction trailer.
- E. Electrified Hardware Drawings:
 - 1. Submit Riser & Wire Diagram drawings RPIGLE082020 showing relationship of all electrical hardware components to door and frame. These drawings shall be included with the submittals and are required to be modified for "as built" and included with the

close out documents.

- a. Include elevation & wiring drawing showing point to point wire hook up for all components. Indicate number and gage of wires required for each item.

1.06 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the requirements and the methods needed for proper performance of the work of this Section.
- B. Supplier qualifications:
 1. A recognized architectural finish hardware supplier with its' parent company located within 250 miles of the project site.
 2. Continuously in business of finish hardware supply for not less than 5 years.
- C. Provide the service of a certified AHC (Architectural Hardware Consultant) to:
 1. Be available for consultation with the Architect at no additional cost to the Owner during progress of construction, and:
 - a. Inspect installation of all finish hardware items;
 - b. Make all minor adjustments required; and
 - c. Report to the Architect on completeness of the installation.
 2. The hardware consultant may be an employee of the supplier.
- D. Installer qualifications: Employ a competent hardware installer with at least five (5) years experience installing commercial grade hardware similar to that proposed for the Work.
- E. Source limitations: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements. Products listed within these documents shall be used without substitution.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with pertinent provisions of Section 01620.
- B. Product identification:
 1. Tag and mark each item separately in manufacturers unopened package, identifying it by product number and architectural opening number, as listed in the approved Finish Hardware Schedule.
 2. Include instructions, templates, and fasteners needed for installation.
- C. Deliver individually packaged hardware items on a vehicle operated by a direct employee of the Hardware Supplier. Contractor shall immediately, and in the presence of the Hardware Supplier, inventory the contents of the delivery.
- D. Hardware supplier: Furnish finish hardware items directly to the factory or mill for factory-installation, where required.

1.08 PROJECT CONDITIONS

- A. Provide a secure, well lit, dry storage area for the sole purpose of storing finish hardware. Prohibit access to all jobsite personnel, except those employed by the installing contractor.

1.09 WARRANTY

- A. Manufacturer's warranty:
 1. Standard manufacturer's warranties apply for products listed in Part 2 products.
 2. Refer to Division 1 for further warranty requirements.
- B. During the warranty period, replace defective work, including labor, materials and other costs incidental to the work. Replace work found to be defective as defined in the General Conditions.
- C. Failures due to defective materials or workmanship to include, but not to be limited to:
 1. Failures in operation of any operating component;
 2. Defects which contribute to unsightly appearance, potential safety hazard, or potential untimely failure of the products furnished under this Section.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each finish hardware item is indicated in the Finish Hardware Schedule at the end of this Section.
- B. Product designations:
 - 1. One or more manufacturers are listed for each hardware type required. Product listed is for basis of design. Only products listed in part 2 product descriptions will be allowed for substitution.
- C. ANSI/BHMA designations:
 - 1. Used to describe hardware items, or to define quality or function. Provide products complying with these standards in addition to additional requirements of this Section.
- D. Hand of door: Drawings show direction of slide, swing ("hand") of door leaves.
- E. Hardware: Use hardware manufactured to conform to published templates and, generally, prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.

2.02 MATERIALS

- A. Base metals:
 - 1. Manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially-recognized) quality than that specified for applicable hardware units by applicable ANSI A156 series standard for each type hardware item and with ANSI A156.18 for finish designations indicated.
 - 2. Do not furnish "optional" materials for those indicated, except as otherwise specified.
- B. Fasteners:
 - 1. Furnish Phillips flat-head screws with each hardware item, unless otherwise indicated.
 - 2. Exposed screws: Match finish of hardware (even where noted to be "prepared for paint").
 - 3. Use concealed fasteners for hardware units which are exposed when door is closed, except where no standard units of type specified are available with concealed fasteners.
 - 4. Do not use thru-bolts where bolt head or nut on opposite face would be exposed.
 - 5. Where adequate reinforcement is not feasible, thru-bolting would only be acceptable if through sleeves, or if sex-screw fasteners are used.
- C. Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of finish hardware.

2.03 MANUFACTURED UNITS, GENERAL

- A. Reference standards:
 - 1. Comply with BHMA/ANSI A156 current series for each product type.
- B. Hardware finishes:
 - 1. Materials and Finishes Standard: Comply with ANSI A156.18 Finish designations used in schedules are listed, therein.
 - 2. Provide matching finishes for hardware units at each door, unless otherwise indicated.
 - 3. Match the color and texture of hardware items to manufacturer's standard finish for the latchset, lockset, or push-pull unit.
 - 4. Provide quality of finish, including thickness of plating or coating, composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than that specified or described by referenced standards.
- C. Hardware for fire-rated openings:
 - 1. Comply with NFPA 80
 - 2. Tested and listed by Underwriters Laboratory (UL), or Factory Mutual (FM) for type, size and use of door, and complying with requirements of door and door frame label.
 - 3. Provide UL or FM label on door indicating "Fire door to be equipped with fire-exit

- hardware".
4. Provide UL or FM label on exit device indicating "Fire Exit Hardware".

2.04 PRODUCTS

- A. Hinges:
1. Butt Hinges:
 - a. ANSI A156.1 - for commercial quality.
 - b. Provide only template-produced units.
 - c. All butt hinges to be ball bearing-5 knuckle type Standard or Heavy Weight as specified.
 - d. Hinges at exterior doors shall be of non-ferrous material.
 - e. All hinges shall be provided Non-removable (NRP)
 - f. Size and number of hinges as specified; otherwise according to hinge manufacturer's recommendation for door size and weight.
 - g. Acceptable products: PDQ, PBB, Don Jo
- B. Lock Cylinders and Keying:
1. General:
 - a. Supplier shall meet with Owner and Architect to finalize keying direction and furnish a complete key schedule. The key schedule shall include keysets, marks and key schedule corresponding to each opening.
 2. Cylinders:
 - a. Type: Mortise or rim-type as required by function of locking device.
 - b. Provide screw on cams or tail piece as required.
 - c. Construct lock cylinder parts from brass/bronze, stainless steel or nickel silver.
 - d. Provide solid machined cylinder rings with tension spring to resist wrenching of cylinder. Length, finish and size as required.
 - e. Provide cylinder(s) and core(s) as required by function for each locking device.
 3. System:
 - a. Provide temporary brass construction cores for each cylinder provided.
 - b. Provide combined SFIC final cores & cut keys as directed by owner.
 4. Keying:
 - a. Deliver keys and final cores to the hardware installation Contractor for final installation, when directed by the Owner.
 - b. Comply with Owner's instructions for master keying and, except as otherwise indicated, provide individual change key for each lock which is not designated to be keyed alike with a group of related locks.
 - c. Key material: Nickel silver
 - d. Key quantity:
 - (1) Two (2) change keys for each lock; Two (2) core keys total.
- C. Locksets:
1. Mortise Locks
 - a. Comply with ANSI A156.13 - 1987, Grade 1 criteria for mortise lock.
 - b. Function: Functions Indicated in the hardware sets.
 - c. Trim: Stainless Steel / Boston lever-type, equal to PDQ.
 - d. Locks shall be built in the USA.
 - e. Lockset case shall to be non-handed and have three-piece latches.
 - f. Acceptable products: PDQ MR series, MBS RE series
- D. Door closers:
1. General:
 - a. ANSI A156.4 - 1986 Grade 1 criteria.
 - b. All closers shall be the products of one manufacturer.
 2. Description:
 - a. Full rack-and-pinion type
 - b. Cast Iron Body.
 - c. Hydraulic fluid: Non-gumming and non-freezing.
 - d. Closer body: Non-handed, multi-size spring power.
 - e. With three non-critical V valves and hex key adjustment to independently

- regulate sweep latch speed and backcheck.
 - f. Provide mounting brackets necessary to clear sound seals and weatherstrip.
 - g. Enclose in a full, molded cover.
 - h. Provide drop plates or special brackets for proper mounting.
 - i. Pressure Relief Valves will not be accepted on Door Closers.
 - j. Provide Barrier Free power setting as required by ANSI A117.1
 - k. Where SCS is specified, furnish a Stainless-Steel swivel snubber.
Stationary snubbers, rubber grommets and studs will not be accepted.
 - 3. Acceptable products: PDQ 7000, LCN 4041XP
- E. Stops:
 - 1. General:
 - a. ANSI A156.16 - 1989 Grade 1 criteria.
 - b. Provide stops where scheduled, wall or floor, as opening conditions dictate, utilizing wall stops wherever possible.
 - 2. Description:
 - a. Wall stops: Cast brass, bronze or stainless steel. Concave wall stop to have stainless steel washer imbedded in rubber stop.
 - b. Floor stops: Cast Stainless, brass or bronze, and plated as required.
 - c. Make selection of floor stop height based upon floor conditions and door undercut.
 - d. Overhead stops: Surface or concealed-mounted overhead stops where scheduled. Size track and arm to door width. Provide thru-bolts when used on fire-rated or hollow core wood doors.
 - 3. Acceptable products: Don Jo, PDQ, Hiawatha
- F. Kick plates, mop plates and armor plates:
 - 1. General: ANSI A156.16 - 1989 criteria.
 - 2. Description:
 - a. Minimum .050" thick
 - b. Dimensions:
 - (1) Width: 2" less than door width to which they are to be applied.
 - (2) Kick plate height: 10"
 - 3. Mounting:
 - a. Install kick plates and armor plates flush to bottom edge of door.
 - b. Notch armor plates for lock or exit device trim or active case.
 - 4. Acceptable manufacturers: Hiawatha, PDQ, Don Jo
- G. Thresholds:
 - 1. General:
 - a. ANSI A156.21 - 1989, Grade 1 criteria.
 - b. Comply with A.D.A. requirements, unless otherwise scheduled.
 - 2. Description:
 - a. Flat profile
 - b. Installation locations are scheduled.
 - c. Provide templates for thresholds to related door suppliers to coordinate proper undercut.
 - 3. Acceptable products: Reese, IDC, KN Crowder
- H. Door Seal and Inside Astragals:
 - 1. General:
 - a. ANSI A156.21 - 1989, Grade 1 criteria.
 - 2. Description:
 - a. Flat profile.
 - b. Dimensions: Appropriate to door opening size.
 - c. Installation locations are scheduled.
 - d. Provide templates for thresholds to related door suppliers to coordinate proper undercut.
 - 3. Mounting:
 - a. Apply related hardware (closer, foot bracket, strike, etc.) on top of hardware

- compatible type weatherstrip.
 - b. Do not notch or splice weather strip.
 - c. Adjust related template hardware locations, as required.
 - 4. Acceptable products: Reese, IDC, KN Crowder.
- I. Sweeps and strips:
 - 1. General:
 - a. ANSI A156.21 - 1989, Grade 1 criteria.
 - 2. Description:
 - a. Flat profile.
 - b. Dimensions: Appropriate to door opening size.
 - c. Installation locations are scheduled.
 - 3. Acceptable products: Reese, IDC, KN Crowder
- J. Miscellaneous Hardware Equipment and Material:
 - 1. General:
 - a. Provide items and types as specified.

2.05 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

2.06 HARDWARE FINISHES

- A. General:
 - 1. Provide matching finishes for hardware units at each door or opening, to the greatest extent possible and except as otherwise indicated.
 - 2. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening.
 - 3. In general, match items to the manufacturer's standard finish for the latch and lock set (or push/pull units if no latch/lock sets) for color and texture.
 - 4. Provide finishes matching those established by BHMA or, if none established, match the Architect's sample.
 - 5. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness and other qualities complying with manufacturer's standards, but in no case less than that specified for the applicable units of hardware by referenced standards.
 - 6. Finish designations used in schedules and elsewhere listed in ANSI A156.18 "Materials and Finishes Standard", including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.
- B. Provide the following hardware finishes, unless otherwise scheduled:
 - 1. Dull Chrome, Stainless Steel, and Aluminum color pallet.
- C. Base material: Manufacturer's standard high-carbon steel, brass, or bronze.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.03 INSTALLATION

- A. General:
 - 1. Install each item in its proper location firmly anchored into position, level and plumb, and in accordance with the manufacturer's recommendations.
 - 2. Hanging, hardware heights, locations, and degree of opening swing are indicated in the Drawings and Finish Hardware Schedule.

3. Mount finish hardware units:
 - a. At recommended heights and locations as shown in approved finish hardware schedule, complying with requirements of the A.D.A., and pertinent provisions of the Building Code.
 - b. To function at proper degree of opening of doors as indicated on approved finish hardware schedule.
 - c. By manufacturer's template.
 - d. Prior to final finishing of the door. Remove hardware to allow finishing of door, and permanently reinstall hardware upon completion of finishing operation.
 4. Reinforce, where necessary, the substrate to assure proper attachment.
 5. Drill and countersink units which are not factory-prepared for anchorage fasteners.
 6. Space fasteners and anchors in accordance with industry standards.
- B. Installing closers:
1. Mount closers per manufacturer's template and secure the Architect's approval of the closer installation.
 2. The Contractor will be required to replace doors onto which closers are improperly mounted at no additional cost to the Owner. Repair or patching of such doors will not be acceptable.
- C. Installing Stops: Install all wall stops into reinforced wall or stud. Install floor stops out of the way foot traffic at a height high enough to accommodate any ramp or uneven floor condition.
- D. Installing thresholds at exterior doors: Set in full bed of butyl-rubber, or polyisobutylene mastic sealant.
- E. Installing weatherstrip: Install weatherstrip prior to installing closers, OH Stops or panic hardware. Template closers and panic devices from weatherstrip and install all closer / OH Stop shoe brackets and panic device strikes onto the weatherstrip without notching or cutting the weatherstrip.
- F. Installing Sweeps: Install all sweeps on exterior side of opening.

3.04 FIELD QUALITY CONTROL

- A. Inspection of final hardware installation: The Contractor, hardware suppliers, and Architectural Hardware Consultant (AHC) shall thoroughly check the quality of the installation and the functionality of each unit of finish hardware at all openings in the Work. The Hardware Supplier shall forward a detailed written report of all operational or installation deficiencies to the Architect and Contractor.

3.05 CLEANING AND ADJUSTING

- A. Check and adjust each item of hardware and each door upon completion of final installation. Verify proper function and replace units which cannot be made to operate freely and smoothly, as intended for the application.
- B. Clean adjacent surfaces soiled by hardware installation

3.06 FINISH HARDWARE SCHEDULE

Hardware Set 1 – Entry Lock [Lock / Unlock] + Closer

3	ea.	Hinges 35SSBB 4545 NRP		32D
1	ea.	Entry Lock MR 116 BJEW SF7		32D
1	ea.	Closer 7101 BC SCS (Push Side Mount)	689	
1	ea.	Kickplate 90 10 x 2" LDW		32D
1	ea.	Threshold S205A		AL
1	ea.	Sweep 354A –Mount pull side	AL	
1	set	Weatherstrip 855C -Mount prior to closer shoe		AL
1	ea.	Rain Drip 201C		AL

Hardware Set 2 – Classroom Lock [Lock / Unlock] + Closer

3	ea.	Hinges 35SSBB 4545 NRP		32D
1	ea.	Classroom Lock MR 148 BJEW SF7		32D
1	ea.	Closer 7101 BC EDA (Push Side Mount)	689	
1	ea.	Kickplate 90 10 x 2" LDW		32D
1	ea.	Wall Stop 1407		26D

Hardware Set 3 – Classroom Lock [Lock / Unlock] + Closer

3	ea.	Hinges 35SSBB 4545 NRP		32D
1	ea.	Classroom Lock MR 148 BJEW SF7		32D
1	ea.	Manual Flush Bolt 282D HAGER		32D
2	ea.	Closer 7101 BC EDA (Pull Side Mount)	689	
1	ea.	Astragal 357 PEMKO (Active Side Mount)		32D
1	ea.	Kickplate 90 10 x 2" LDW		32D
1	ea.	Wall Stop 1407		26D

END OF SECTION

SECTION 08 8000

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glazing units.
- B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 08 1113 – Hollow Metal Doors and Frames

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- E. ASTM C1036 - Standard Specification for Flat Glass.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
- G. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- H. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.
- I. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
- J. GANA (GM) - GANA Glazing Manual.
- K. GANA (SM) - GANA Sealant Manual.
- L. GANA (LGRM) - Laminated Glazing Reference Manual.
- M. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use.
- N. NFRC 100 - Procedure for Determining Fenestration Product U-factors.
- O. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
- P. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.05 SUBMITTALS

- See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data on Insulating Glass Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Shop Drawings: Indicate glazing sizes and locations.
- E. Installer's Qualification Statement.
- F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.07 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Glass Fabricators:
 - 1. Viracon, Inc: www.viracon.com.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Float Glass Manufacturers:
 - 1. Guardian Glass, LLC: www.guardianglass.com.
 - 2. Pilkington North America Inc: www.pilkington.com/na.
 - 3. Substitutions: Refer to Section 01 6000 - Product Requirements.
- C. Fire-Rated Glass: Provide products as required to achieve indicated fire-rating period.
 - 1. Manufacturers:
 - a. Technical Glass Products; Pilkington Pyrostop: www.fireglass.com.
 - b. Substitutions: Refer to Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - 1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 - 2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 - 3. Glass thicknesses listed are minimum.
- B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
 - 1. In conjunction with vapor retarder and air barrier and joint sealer materials described in other sections.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
 - 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 - 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 - 3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
 - 1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
 - 2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
 - 3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
 - 4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.

2.04 INSULATING GLASS UNITS

- A. Manufacturers:
 - 1. Guardian Glass, LLC: www.guardianglass.com.
 - 2. Pilkington North America Inc: www.pilkington.com.
 - 3. Viracon, Apogee Enterprises, Inc: www.viracon.com.
- B. Insulating Glass Units: Types as indicated.
 - 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 - 2. Spacer Color: Black.
 - 3. Edge Seal:
 - a. Color: Black.
 - 4. Purge interpane space with dry air, hermetically sealed.
- C. Insulating Glass Units: Vision glass, double glazed.
 - 1. Applications: Exterior glazing unless otherwise indicated.
 - 2. Space between lites filled with air.
 - 3. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
 - a. Tint: None
 - b. Coating: Low-E (passive type), on #2 surface, or manufacturer's recommendation.
 - 4. Inboard Lite: Annealed float glass, 1/4 inch thick, laminated for blast resistance
 - a. Tint: None
 - b. The 1/4 in. laminated glass consists of two nominal 1/8 in. glass panes bonded together with a minimum of a 0.030 in. interlayer of a material that has typically been used in blast resistant window applications. For insulated glass units (IGU), laminated glass shall be provided at the innermost pane.
 - 5. Total Thickness: 1 inch.

2.05 GLAZING COMPOUNDS

- A. Butyl Sealant: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.
- B. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; black color.
- C. For laminated glass, the laminated pane shall be adhered to its supporting frame using structural silicone sealant or adhesive glazing tape. The structural silicone sealant bite shall be equal to the larger of 3/8-in. or the thickness of the laminated glass to which it adheres. The minimum thickness of the structural silicone bead shall be 3/16-in.. The glazing tape bite shall be equal to two times the thickness of the laminated glass to which it adheres. The structural silicone bead or glazing tape shall be applied to the inboard (protected) side of an IGU.
- D. Manufacturers:
 - 1. BASF Corporation: www.basf.com.
 - 2. Bostik Inc: www.bostik-us.com.
 - 3. Dow Corning Corporation: www.dowcorning.com/construction.
 - 4. Tremco Commercial Sealants & Waterproofing; Proglaze SSG: www.tremcosealants.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.06 ACCESSORIES

- A. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
 - 1. Width: As required for application.
 - 2. Thickness: As required for application.
 - 3. Spacer Rod Diameter: As required for application.
 - 4. Manufacturers:
 - a. Pecora Corporation: www.pecora.com.
 - b. Tremco Global Sealants: www.tremcosealants.com.
- B. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.
- C. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

3.04 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove non-permanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.05 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

**SECTION 09 2116
GYPSUM BOARD ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Gypsum wallboard.
- B. Joint treatment and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
- B. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- C. ASTM C1396 - Standard Specification for Gypsum Board.
- D. GA-216 - Application and Finishing of Gypsum Panel Products.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.05 DELIVER, STORAGE, AND HANDLING

- A. Deliver materials to the project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade.
- B. Store off the ground in a dry ventilated space or protect with suitable waterproof coverings.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
 - 1. See PART 3 for finishing requirements.
 - 1. Refer to Section 09 5100 – Acoustical Ceilings.

2.02 BOARD MATERIALS

- A. Manufacturers – Moisture Resistant Gypsum Board:
 - 1. CertainTeed Corporation: ProRoc; www.certainteed.com.
 - 2. Georgia-Pacific Gypsum: Toughrock; www.gpgypsum.com.
 - 3. Gold Bond Building Products: Gold Bond XP; goldbondbuilding.com
 - 4. USG Corporation: Sheetrock Brand Mold Tough; www.usg.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 - 2. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 - a. CertainTeed Corporation; Type X Drywall.
 - b. Georgia-Pacific Gypsum; ToughRock Fireguard X.
 - c. National Gypsum Company; Gold Bond BRAND Fire-Shield Gypsum Board.
 - 3. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Ceilings: 5/8 inch.
 - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.

2.03 GYPSUM WALLBOARD ACCESSORIES

- A. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel, unless noted otherwise.
 - 1. Corner Beads: Mud-on, paper-faced composite corner bead that adjusts to any angle to create inside and outside 90° and off-angle corners.
 - a. Products:
 - 1) ClarkDietrich: Strait-Flex Gold Corner Bead; www.clarkdietrich.com.
 - 2) Substitutions: See Section 01 6000 - Product Requirements.
 - 2. J-Channels: Trim-Tex, Inc.
 - 1) Substitutions: See Section 01 6000 - Product Requirements.
- B. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.
 - 1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
 - 2. Joint Compound: Setting type, field-mixed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

3.03 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.04 JOINT TREATMENT

- A. Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 1: Fire-resistance-rated wall areas whether or not accessible in the completed construction.
 - 2. Level 4: All other surfaces.
- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.

END OF SECTION

SECTION 09 9113
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Exposed surfaces of steel lintels and ledge angles.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Non-metallic flashing.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 05 5000 - Metal Fabrication
- B. Section 09 9123 - Interior Painting.

1.03 REFERENCE STANDARDS

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.
- B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- C. SCAQMD 1113 - Architectural Coatings 1977 (Amended 2016).
- D. SSPC V1 (PM1) - Good Painting Practice: Painting Manual, Volume 1 2016.
- E. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual, Volume 2 2015.
- F. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- G. SSPC-SP 2 - Hand Tool Cleaning 2018.
- H. SSPC-SP 3 - Power Tool Cleaning 2018.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 - 4. Manufacturer's installation instructions.
 - 5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

- C. Samples: Submit two paper chip samples, 2" x 3" inch in size illustrating range of colors and textures available for each surface finishing product scheduled.
- D. Manufacturer's Instructions: Indicate special surface preparation procedures.
- E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years' experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft. candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
 - 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
- B. Paints:
 - 1. Basis of Design Manufacturer: Sherwin-Williams Company: www.sherwin-williams.com.
 - 2. Behr Process Corporation: www.behr.com.
 - 3. PPG Paints: www.ppgpaints.com.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 3. Supply each paint material in quantity required to complete entire project's work from a single production run.
 4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Flammability: Comply with applicable code for surface burning characteristics.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- D. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Architect after award of contract.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Paint E - Exterior Surfaces to be Painted, as indicated on the drawings: Including concrete, concrete masonry units, and primed metal.
1. Products:
 - a. Sherwin-Williams: Resilience, Satin. (MPI #15)
 - b. Substitutions: Section 01 6000 - Product Requirements.
- B. Paint CE-3L - Masonry/Concrete, Opaque, Latex, 3 Coat:
1. One coat of block filler.
 2. Semi-gloss: Two coats of latex enamel.
- C. Paint ME-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:
1. One coat of latex primer.
 2. Semi-gloss: Two coats of latex enamel.
- D. Paint ME-2L - Ferrous Metals, Primed, Latex, 2 Coat:
1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
 2. Semi-gloss: Two coats of latex enamel.
- E. Paint MgE-3L - Galvanized Metals, Latex, 3 Coat:
1. One coat galvanize primer.
 2. Semi-gloss: Two coats of latex enamel.
 - a. Use SW4084 – Safety Yellow on all bollards, interior and exterior, and guardrails.
- F. Paint E-Pav - Pavement Marking Paint:
1. Yellow: One coat, with reflective particles.
 2. White: One coat, with reflective particles.

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 - 2. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Concrete:
 - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 2. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.
- H. Masonry:
 - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 2. Prepare surface as recommended by top coat manufacturer.
- I. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- J. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- K. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- L. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer. Protect from corrosion until coated.
- M. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions.
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance.
- F. Sand metal surfaces lightly between coats to achieve required finish.

- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 9123
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

- A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.
- B. SSPC-SP 1 - Solvent Cleaning.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit two paper chip samples, 2 by 3 inch in size illustrating range of colors and textures available for each surface finishing product scheduled.
- D. Manufacturer's Instructions: Indicate special surface preparation procedures.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.05 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.
- D. Application Temperatures for Paints: Between 45 and 90 degrees F.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Paints, Basis of Design Products:
 - 1. Sherwin-Williams Company: www.sherwin-williams.com.
 - a. Refer to drawings for type.
- B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. Color: As selected by Architect from manufacturer's full range.
- D. Touch-up paint for the pre-engineered metal building shall match the building manufacturer's.

2.03 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
 - 1. Walls, in all areas: PrepRite ProBlock Interior/Exterior Latex Primer/Sealer, SW6504.
 - 2. Existing PEMB trusses and purlins and trench grates: Zinc Clad 5, organic zinc-rich primer.

2.04 PAINT – WALLS:

- A. Typical throughout the facility:
 - 1. 1st Coat: Pro-Industrial Pre-catalyzed Water Based Epoxy, semi-gloss, K46 Series.
 - 2. 2nd Coat: Pro-Industrial Pre-catalyzed Water Based Epoxy semi-gloss, K46 Series.

2.06 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.

- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 - 3. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Gypsum Board and Concrete Masonry Units: Fill minor defects with filler compound. Spot prime defects after repair.
- G. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- H. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- D. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for completely hide.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.
- B. Owner will provide field inspection.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 10 1400

SIGNAGE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

- A. Extent of signage is shown on the Drawings by symbols and numbers.
- B. Forms of signage required include:
 - 1. Interior signage
 - 2. Exterior signage

1.03 QUALIFICATIONS

- A. The sign contractor shall have experience with this type of project, and shall have installed and fabricated signs from 5 projects of similar magnitude and design and if requested, prior to being awarded a contract, shall submit the names, locations, contacts, and the telephone numbers for the five most recently installed, completed projects.

1.04 SUBMITTALS

- A. Shop Drawings
 - 1. Submit shop drawings for fabrication and erection of signs. Include elevations, and large scale details of sign wording and lettering layout. Show anchorages and accessory items. Furnish location template drawings for items supported or anchored to permanent construction.
- B. Product Data: Submit manufacturer's technical data and installation instruction for each type of sign required.
- C. Submit manufacturers standard color samples and sample of each color to be used.
- D. Submit properly identified manufacturers standard product data.
- E. Submit a complete list of all signage.
- F. Provide sample of sign for approval by the Owner and Architect.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver signs for timely installation, minimizing on-site storage time.
- B. Deliver components safety packed to prevent damage.
- C. Store in secure areas, out of weather and protect from work of other trades.
- D. All packages shall identify contents.

1.06 CODE COMPLIANCE

- A. All signs shall be constructed and mounted in accordance with the latest edition of the State of Michigan Construction Code.
- B. All signs shall be constructed and mounted in accordance with the American with Disability Act Accessibility Guidelines including but not limited to compliance with:
 - 1. Location
 - 2. Height
 - 3. Sign and font size
 - 4. Tactile requirements
 - 5. Braille requirements
 - 6. Symbol requirements

PART 2 - PRODUCTS

2.01 INTERIOR SIGNAGE

- A. Basis of Design: As manufactured by Appenx, Inc., 1730 Lincoln Ave., Holland, MI 49423, (800)433-6032; www.appenx.com, or as approved by Architect.
 - 1. Signage shall occur at all rooms and spaces.
 - 2. Directional and wayfinding to be verified and confirmed with Owner.
 - 3. Color and style to be selected by Architect.
- B. Identification Signage:
 - 1. Signs for identification of rooms of the building shall be manufacturers standard raised plastic.
 - 2. Signage shall include Room Name and Room Number.
 - 3. Signage shall be in English.
 - 4. Letters shall be one inch high, with Univers 55 uppercase letters and shall be accompanied with Grade 2 Braille markings. Letters and numbers shall have a width-to-height ratio between 3:5 and 1:1 and a stroke width-to-height ratio between 1:5 and 1:10. Sign colors to be selected by the Architect.
 - 5. Master room numbering system. All signs shall be as described above on plaque with Helvetica Medium numbers. Master room numbering signs shall indicate location of room on each corridor by means of room numbers and arrows.
 - 6. Room signage shall be as described above on the following:
 - a. Supply and Storage Rooms- 2 1/2" x 10" with 1/2" diameter corner radius.
 - b. Men's and Women's Toilet Rooms- 8" x 8" with 1/2" diameter corner radius and shall read "Men"/ "Women" including handicap accessible symbol and braille.
 - c. All other room signage- 4" x 10" with 1/2" diameter corner radius.
- C. All signs shall meet all ADA and ANSI requirements including but not limited to width to height ratio, stroke width to height ratio, grade to Braille marking, and mounting location.
- D. Secure all signs with adhesive or fasteners per manufacturers requirements.
- E. Provide ADA/ANSI compliant pictorial signage at all public toilet rooms.
 - 1. Pictorial signs shall be similar to Best "WP 200 Series" word and picture signs. Signs shall be ES plastic. Signs selected consist of numbers WP 247 (men), WP 248 (women) WP 225 (handicap symbol) and shall include equivalent raised verbal description and Braille markings directly below each pictogram.
- F. Provide "exit" sign with raised letters and braille markings at all doors to an exit discharge, exit passageway.
- G. Other interior signage and/or locations as indicated on the drawings or as required.

2.02 EXTERIOR SIGNAGE

- A. Basis of Design: As manufactured by Emedco; www.emedco.com, or as approved by Architect.
 - 4. Signage shall occur at all locations as indicated on the drawings.
 - 5. Directional and wayfinding to be verified and confirmed with Owner.
 - 6. Color and style to be selected by Architect.
- B. Identification Signage:
 - 7. Signs for Safety and Compliance / Traffic shall be constructed of aluminum.
 - 8. Signage shall include verbage as indicated on the drawings.
 - 9. Signage shall be in English.
 - 10. Sign colors to be selected by the Architect.
 - 11. Traffic signage shall be as described above on the following:
 - a. One way signage- 18 inch wide x 24 inch high with radius corners.

PART 3 - EXECUTION

3.01 GENERAL

- A. Locate site units and accessories where shown or scheduled, using mounting methods in compliance with the manufacturer's instruction.
 - 1. Install sign units level, plumb and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

3.02 INSPECTION

- A. Inspect surfaces prior to installation.
- B. Do not install materials until surfaces are acceptable.

3.03 INSTALLATION

- A. Install signs according to locations and heights as shown and detailed on the Drawings. Install signage per manufacturer's instructions.
 - 1. Interior signs shall be adhesively mounted on walls adjacent to the latch side of doors. All signs shall be attached approximately 60 inches above floor level to the center of the sign.

3.04 CLEANING

- A. Clean signs. Use non-abrasive cleaning agents as recommended by the manufacturer such as soap and water or other household cleansers.

3.05 ALUMINUM VEHICULAR SIGNS

- A. Aluminum must be chemically etched, degreased and it must be flat and free of ragged edges. Corner radii shall be made by stamping with dies or computer routed, and all signs of the same size shall be totally uniform in size and shape.
- B. Aluminum shall have pre-punched holes for fasteners to prevent damage to signs in the field. Refer to sign mounting details for location and spacing of fasteners.
- C. Clear coat sign face if exposed to ultraviolet rays.
- D. Backs and edges of signs mounted directly to concrete construction shall have two (2) coats of baked epoxy enamel paint on backside of sign to prevent cathodic reaction with the structure. Baked epoxy enamel shall be applied to pre-punched blank prior to fabricating sign.

END OF SECTION

SECTION 10 4400
PORTABLE FIRE EXTINGUISHERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

- A. Work Included
 - 1. Furnish all labor, materials and equipment required, and furnish and install all portable fire extinguishers and cabinets, complete with all accessories and incidentals required, in accordance with the Drawings and Specifications.

1.03 QUALITY ASSURANCE

- A. Codes and Standards
 - 1. Perform all work in accordance with local State ordinance and as required by the governing Fire Marshal.

1.04 SUBMITTALS

- A. Materials List
 - 1. Submit to the Architect a complete list of all materials, including manufacturer's names, to be furnished and installed under this portion of the Work.
- B. Shop Drawings
 - 1. Submit complete shop drawings and manufacturer's cuts and literature to the Architect for review.

1.05 PRODUCT HANDLING

- A. Protection
 - 1. Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Replacements
 - 1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Provide portable fire extinguishers manufactured by one of the following:
 - 1. JL Industries; www.activarcpg.com
 - 2. General Fire Extinguisher Corporation
 - 3. Walter Kidde and Company
 - 4. Norris Industries
 - 5. Fire Defense Equipment Co., Inc.

2.02 FIRE EXTINGUISHERS

- A. Provide fire extinguishers in surface mounted locations as shown on the Drawings. Furnish only new fire extinguishers which are approved and labeled by Underwriters' Laboratories.
- B. Provide manufacturer's standard mounting brackets for extinguishers.
- C. Fire extinguishers shall be multi-purpose dry chemical type, 10 lb. capacity, enameled steel container with pressure-indicating gauge, for Class A, B, C fires.
- D. Basis of Design: JL Industries; Cosmic 10E; www.activarcpg.com

2.04 SURFACE MOUNTING

- A. Fire Extinguisher Bracket: Surface mounted J hook with capacity to support minimum ten pound fire extinguisher.
- B. Finish: stainless steel.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in locations and at mounting height to comply with governing authorities.

END OF SECTION

SECTION 10 7313
METAL AWNINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
1. Fixed metal awnings.

1.02 PERFORMANCE REQUIREMENTS

- A. General: Design, fabricate, and install awnings to withstand loads from gravity, wind and snow; and to resist, without failure, other conditions of in-service use, including exposure to weather.

1.03 SUBMITTALS

- A. Product Data: Include styles, material descriptions, construction details, fabrication details, dimensions of individual components and profiles, hardware, fittings, mounting accessories, features, finishes, and operating instructions for awnings.
- B. Shop Drawings: Show location and extent of awnings. Include elevations, sections, and details not shown in Product Data. Show materials, fabrication, dimensions, mounting heights, connections, anchorages, installation details, attachments to other work, operational clearances, and relationship to adjoining work.
1. Show locations for blocking, reinforcement, and supplementary structural support to be provided by others.
- C. Samples for Verification: Provide sample of metal panel and full range of available colors.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum (5) years experience in similar work.
- B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- C. Source Limitations: Obtain awnings through one source from a single manufacturer.

1.05 PROJECT CONDITIONS

- A. Field Measurements: Where awning installation is indicated to fit to other work, verify dimensions of other work by field measurements before fabrication and indicate measurements on Shop Drawings. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work

1.06 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer and fabricator agree to repair or replace components of awnings that fail in materials or workmanship within specified warranty period.
1. Exposed Roof Panel Finish Warranty Period: Twenty (20) years.
 2. Awning Frame Warranty Period: Five (5) years.
 3. Awning Installation Warranty Period: One (1) year.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer: QUEEN CITY AWNING
7225 East Kemper Road, Cincinnati, Ohio 45249, Tel. 800-611-2800, 513-530-9660
Fax 513-530-0662, info@QueenCityAwning.com, www.QueenCityAwning.com
- B. Basis of Design: Armor-Clad Metal Awning System by Queen City Awning

2.02 STANDING-SEAM METAL ROOF PANELS

- A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically

attaching panels to supports using concealed clips in side laps. Include clips, cleats, and accessories required for installation.

1. Material: Zinc-coated (galvanized) steel sheet, 24 gauge, 0.024-inch nominal thickness.
 - a. Exterior Finish: 2-coat fluoropolymer.
 - b. Color: As selected by Architect from manufacturer's full range.
2. Panel Height: Standard Seam Spacing for MP100 Panel is 14.5".

2.03 AWNING FRAMES

- A. Steel Frames:
 1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 2. Cold-Formed Steel Tubing: ASTM A 500, grade as required by structural loads.
 3. Steel Finish: Manufacturer's standard decorative finish complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, and minimum dry film thickness.
- B. Aluminum Frames: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability properties of alloy and temper required by structural loads.
- C. Anchors, Fasteners, Fittings, Hardware, and Installation Accessories: Complying with performance requirements indicated and suitable for exposure conditions, supporting structure, anchoring substrates, and installation methods indicated. Provide as required for awning assembly, mounting, and secure attachment.

2.06 AWNING FABRICATION

- A. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Frames: Preassemble awning frames in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

2.07 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a temporary protective covering before shipping.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for supporting members, blocking, inserts, installation tolerances, lighting, and other conditions affecting performance.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. General: Install awnings at locations and in position indicated, securely connected to supports, free of rack, and in proper relation to adjacent construction. Use mounting methods of types described and in compliance with Shop Drawings and fabricator's written instructions.
- B. Install awnings after other finishing operations, including joint sealing and painting, have been completed.
- C. Attach metal roof panels to frames as recommended by fabricator.
- D. Anchoring to In-Place Construction: Use anchors, fasteners, fittings, hardware, and installation accessories where necessary for securing awnings to structural support and for properly transferring load to in-place construction.

3.03 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Clean awning surfaces after installation, according to manufacturer's written instructions.
- D. Touchup Painting: Immediately after erection, clean field welds, connections, and abraded areas. Paint uncoated and abraded areas with same or compatible material as used for shop-applied finish painting.
- E. Galvanized Surfaces: Clean field welds, connections, and abraded areas and repair galvanizing.
- F. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that awnings are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 11 1126
WASH BAY SYSTEM (N.I.C.)

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included: Provide a complete wash bay system.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's product data.
- B. Shop Drawings: Submit shop drawings including equipment, electrical and mechanical layouts, construction interface, and dimensions.
- C. Warranty: Submit executed copy of manufacturer's standard warranty.

1.03 QUALITY ASSURANCE

- A. Manufacturer: A minimum of 5 years experience manufacturing similar products.
- B. Installer: A minimum of 2 years experience installing similar products.
- C. Manufacturer's Quality System: Registered to ISO 9001 Quality Standards including in-house engineering for product design activities.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in manufacturer's original packaging. Store materials in a dry, protected area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.05 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials and equipment shall be free of defects in material and workmanship for a minimum period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 – PRODUCTS

2.01 WASHER MANUFACTURER

- A. Basis-of-Design: Hotsy, Wash Bay System Model 5732SS-208, www.hotsy.com.
- B. Substitutions: See Section 01 6000 – Product Requirements.

2.01 BOOM MANUFACTURER

- A. Basis-of-Design: Mosmatic Corporation, WSA and WAE, www.swivels@mosmatic.com.
- B. Substitutions: See Section 01 6000 – Product Requirements.

2.01 WATER CANNON MANUFACTURER

- A. Basis-of-Design: Mi-T-M Corporation, WSA and WAE, www.swivels@mosmatic.com.
- B. Substitutions: See Section 01 6000 – Product Requirements.

2.02 SYSTEM COMPONENTS

- A. Pressure Washer:
 - 1. Pump: Hotsy Model 5732SS-208
 - a. Output: 720,000 btu/hr, 8.0 gpm @ 3000 psi.
 - b. Motor: 20 hp, 208 volt, 3 phase, 55 amp.
 - c. Natural Gas.
 - d. Water Line: 3/4inch.
 - e. Remote Control Ready / Auto Start Stop
 - f. Power Vent Damper
 - g. Dimensions: 51 inches(L) x 31 inches(W) x 63.4(H) inches.

- h. Weight: 1020 lbs.
- B. Machine Stand: manufacturer standard.
- C. Gun System:
 - 1. (2) two guns each with overhead boom, one each end of each wash bay. Provide (4) four guns total
 - 2. Turbo and undercarriage nozzles.
 - 3. 3000 psi.
- D. Detergent: Downstream detergent injectors
- E. Overhead Booms:
 - 1. Mosmatic Model DKP 66.089, 9'-10" long.
 - 2. 360 degrees rotation.
 - 3. Emergency quick release.
 - 4. Ceiling extension, sized to fit application. V.I.F.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.
 - 1. Test units for proper function and adjust until proper operation is achieved.
 - 2. Repair finishes damaged during installation.
 - 3. All field plumbing and mechanical work will be performed by mechanical contractor.
 - 4. The equipment module shall include electrical panel, tank float switches, and pump and shall be prewired and tested prior to shipment to the site.
 - 5. Electrical service and interconnecting various equipment components shall be done by the electrical contractor.

3.03 ADJUSTING AND CLEANING

- A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

END OF SECTION

**SECTION 13 3419
METAL BUILDING SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufacturer-engineered, shop-fabricated structural steel building frame.
- B. Metal wall and roof panels.

1.02 RELATED REQUIREMENTS

- A. Section 01 4533 – Code Required Special Inspections and Procedures
- B. Section 03 3000 – Cast-In-Place Concrete.
- C. Section 04 2000 – Unit Masonry.
- D. Section 05 5000 - Metal Fabrications.
- E. Section 07 4213 – Interior Metal Liner Panels.
- F. Section 07 9200 - Joint Sealants: Sealing joints between accessory components and wall system.
- G. Section 08 1113 - Hollow Metal Doors and Frames.
- H. Section 08 3613 - Sectional Doors.
- I. Section 08 4500 – Insulated Translucent Panel System

1.03 REFERENCE STANDARDS

- A. AISC 360 - Specification for Structural Steel Buildings 2016.
- B. ASTM A36 - Standard Specification for Carbon Structural Steel 2014.
- C. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2014, with Editorial Revision (2017).
- E. ASTM A529 - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality 2014.
- F. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2019a.
- G. ASTM F3125 - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength 2019.
- H. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2012.
- I. IAS AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems 2018.
- J. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic") 2002 (Ed. 2004).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on profiles, component dimensions, fasteners.
- C. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections; wall and roof system dimensions, panel layout, general construction details, anchors and methods of anchorage, and installation; framing anchor bolt settings, sizes, locations from datum, and foundation loads; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature.

- D. Samples: Submit two samples of pre-coated metal panels for each color selected, illustrating color and texture of finish.
- E. Manufacturer's Instructions: Indicate preparation requirements, anchor bolt placement.
- F. Erection Drawings: Indicate members by label, assembly sequence, and temporary erection bracing.
- G. Designer's Qualification Statement.
- H. Manufacturer's Qualification Statement: Provide documentation showing metal building manufacturer is accredited under IAS AC472.
 - 1. Include statement that manufacturer designs and fabricates metal building system as integrated components and assemblies, including but not limited to primary structural members, secondary members, joints, roof, and wall cladding components specifically designed to support and transfer loads and properly assembled components form a complete or partial building shell.
- I. Erector's Qualification Statement.

1.05 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide a five (5) year manufacturer warranty for materials, unless noted otherwise.
 - 1. Include coverage for exterior pre-finished surfaces to cover pre-finished color coat against chipping, cracking or crazing, blistering, peeling, chalking, or fading. Include coverage for weather tightness of building enclosure elements after installation.
- D. Provide a twenty five (25) year manufacturer warranty for roof finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Buildings Systems:
 - 1. Nucor Building Systems: www.nucorbuildingsystems.com
 - 2. MBCI: www.mbc.com
 - 3. American Building Company; www.americanbuildings.com
 - 4. Butler Manufacturing Company: www.butlermfg.com.
 - 5. Chief Buildings: www.chiefbuildings.com.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ASSEMBLIES

- A. Continuous beam frame.
- B. Primary Framing: Rigid frame of rafter beams and columns, intermediate columns, braced end frames, and end wall columns, and wind bracing.
- C. Secondary Framing: Roof Purlins, Interior Z Girts to Support Ceiling Mounted Liner Panels, Wall Girts, Eave struts, Flange bracing, and Clips, and other items detailed.
- D. Wall System: Preformed metal panels of vertical profile to match existing with sub-girt framing/anchorage assembly and insulation where indicated on the drawings, and accessory components. Typical for panels Type-1 and Type-2 on exterior and liner panels at the interior.
- E. Roof System: Preformed metal panels oriented parallel to slope, with sub-girt framing/anchorage assembly, insulation, interior liner panel, and accessory components.
- F. Roof Slope: Match existing – approximate slope = 1 inches in 12 inches.
- G. Interior Liner Panels: Refer to Section 07 4213 - Interior Metal Liner Panels.
- H. Insulation: Refer to Section 07 2110 – PEMB Insulation.

2.03 PERFORMANCE REQUIREMENTS

- A. Design structural members to withstand dead load, applicable snow load, and design loads due to pressure and suction of wind calculated in accordance with applicable code.
- B. Exterior wall and roof system shall withstand imposed loads with maximum allowable deflection of 1/90 of span.
- C. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.
- D. Permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.
- E. Size and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance.

2.04 MATERIALS - FRAMING

- A. Structural Steel Members: ASTM A36, galvanized
- B. Structural Tubing: ASTM A500 Grade B cold-formed, galvanized
- C. Plate or Bar Stock: ASTM A529, Grade 50, galvanized
- D. Anchor Bolts: ASTM A307, Grade A, with no preference for protective coatings.
- E. Bolts, Nuts, and Washers: ASTM F3125, Type 1; galvanized to ASTM A153.
- F. Welding Materials: Type required for materials being welded.
- G. Primer: SSPC-Paint 20 zinc rich.
- H. Grout: ASTM C1107; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

2.05 MATERIALS - WALLS AND ROOF

- A. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653, Designation SS (structural steel), Grade 55, with G90 coating.
- B. Insulation: Refer to Section 07 2110 – PEMB Insulation.
- C. Joint Seal Gaskets: Manufacturer's standard type.
- D. Fasteners: Manufacturer's standard type, galvanized to comply with requirements of ASTM A153, finish to match adjacent surfaces when exterior exposed.
- E. Trim, Closure Pieces, Caps, Flashings, Gutters, Downspouts, Rain Water Diverter, Fascias, and Infills: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

2.06 COMPONENTS

- A. Doors and Frames: Specified in Section 08 1113.
- B. Overhead Doors: Specified in Section 08 3613.

2.07 FABRICATION - FRAMING

- A. Fabricate members in accordance with AISC 360 for plate, bar, tube, or rolled structural shapes.

2.08 FABRICATION - WALL AND ROOF PANELS

- A. Siding:
 - 1. Type 1: Minimum 26 ga. metal thickness, NUCOR A-Panel profile, 1.25 inch deep, 36 inch coverage, lapped edges fitted with continuous gaskets.
 - 2. Type 2: Minimum 24 ga. metal thickness, MBCI FW-120 Panel profile (match existing), 1.5 inch deep, 12 inch coverage
- B. Roofing: Minimum 24 ga. metal thickness, Standing Seam II profile, 24 inch coverage with 2 inch high ribs, lapped edges fitted with continuous gaskets.
- C. Liner: Refer to Section 07 4213 – Interior Liner Panels

- D. Girts/Purlins: Rolled formed structural shape to receive siding, roofing and liner sheet.
- E. Flashings, Closure Pieces, Fascia: Same material and finish as adjacent material, profile to suit system.
- F. Fasteners: To maintain load requirements and weather tight installation, same finish as cladding, non-corrosive type.

2.09 FINISHES

- A. Framing Members: Clean, prepare, and shop prime. Factory galvanized and primed. Do not prime surfaces to be field welded.
- B. Exterior Surfaces of Wall Components and Accessories: Precoated enamel on steel of modified silicone finish, color as selected by architect from manufacturer's standard range.
- C. Interior Surfaces of Wall Components and Accessories: Precoated enamel on steel of modified silicone finish, color to match existing.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position

3.02 ERECTION - FRAMING

- A. Erect framing in accordance with AISC 360.
- B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as indicated.
- C. Set column base plates with non-shrink grout to achieve full plate bearing.
- D. Do not field cut or alter structural members without approval.
- E. After erection, prime welds, abrasions, and surfaces not shop primed.

3.03 ERECTION - WALL AND ROOF PANELS

- A. Install in accordance with manufacturer's instructions.
- B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.
- C. Fasten cladding system to structural supports, aligned level and plumb.
- D. Locate end laps over supports. End laps minimum 2 inches. Place side laps over bearing.
- E. Provide expansion joints where indicated.
- F. Use concealed fasteners.
- G. Install sealant and gaskets, providing weather tight installation.

3.04 INSTALLATION - ACCESSORY COMPONENTS IN WALL SYSTEM

- A. Install door frames, doors, and overhead doors in accordance with manufacturer's instructions.

3.05 TOLERANCES

- A. Framing Members: 1/4 inch from level; 1/8 inch from plumb.
- B. Siding and Roofing: 1/8 inch from true position.

END OF SECTION

SECTION 22 00 00
PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY OF WORK

- A. Furnish labor, materials, and equipment necessary for completion of work as described in Contract Documents.
- B. It is the intent of these specifications that the systems specified herein are to be complete and operational before being turned over to the owner. During the bidding process, the contractor is to ask questions or call to the engineer's attention any items that are not shown or may be required to make the system complete and operational. Once the project is bid and the contractor has accepted the contract, it is his responsibility to furnish and install all equipment and parts necessary to provide a complete and operational system without additional cost to the owner. The work shall also include any items which, while not specifically included in the Contract Documents, are reasonable and are accepted trade practices or necessary for the proper completion of the systems.
- C. Furnish and install fire stopping materials to seal penetrations through fire rated structures and draft stops.

1.03 DRAWINGS AND SPECIFICATIONS

- A. Drawings are diagrammatic and are intended to convey a general arrangement and scope of the work included in the contract. Should drawings contradict themselves or the Specifications, the better quality or greater quantity of work shall be included.
- B. The Plumbing Contractor shall be familiar with all Architectural, Civil, Structural, Fire Protection, Mechanical and Electrical Drawings and Specification Sections, and shall follow any special requirements or directions included in these areas.
- C. Drawings and Specifications are intended to include all work and materials necessary for completion of the work. Any incidental item of material, labor or detail required for the proper execution and completion of the work and omitted from either the drawings and specifications or both, but required by governing codes local regulations, trade practices, operational functions, and good workmanship, shall be provided as part of the Contract Work without extra charge, even though not specifically detailed or specified.
- D. Should there be any question as to the scope of work for which the Plumbing Contractor is responsible, they should request an interpretation before submitting their bid. After contracts are awarded, the Owner shall not be responsible for claims for extras for work that was not included because the Plumbing Contractor was unsure if they should include given work in their bid.

1.04 SUBMITTALS

- A. Substitutions: By specific designation and description, standards are established for specialties and equipment. Other makes of specialties and equipment of equal quality will be considered provided such proposed substitutions are submitted to the Architect for his approval, complete with specification data showing how it meets the specifications, at least 5 working days prior to bid opening. A list of approved substitutions will be published as an addendum.
- B. Product Data & Shop Drawings:
 - 1. Portable Document Format (PDF) files of shop drawings on all equipment and materials indicated on the Drawings for approval, prior to placing delivery orders (also refer to

Architectural Specifications for shop drawing requirements). PDF files shall be e-mailed to the Construction Manager.

2. At the time of submittal for review by the Engineer, shop drawings shall include signatures or stamps indicating that the Contractor and/or the Sub-Contractor has reviewed the submittals and has coordinated the required space, quantities required, services and work of other trades for the equipment or system being submitted.
3. Provide shop drawings of all manufactured equipment and materials except pipe, pipe fittings. Drawings shall include equipment capacities, weights, dimensions, construction details, installation, controls, wiring diagrams, and motor data.
4. Mark literature to indicate specific item with applicable data underlined.
5. Engineer's approval of shop drawings is for general application only and is a service only and not considered as a guarantee of total compliance with or as relieving the Plumbing Contractor of basic responsibilities under all contract documents and does not approve changes in time or cost.
6. After approval, the Plumbing Contractor and its subcontractors are responsible for providing information to all other trades involved in, or affected by, the installation of the Plumbing equipment.

1.05 SITE AND PROJECT DOCUMENT EXAMINATION

- A. Submission of a bid proposal is considered evidence that the Plumbing Contractor has completed the following:
 1. Informed themselves of the site conditions.
 2. Examined Drawings and Specifications of all trades including Architectural, Structural, Mechanical and Electrical, and is proficient, experienced and knowledgeable of all standards, codes, ordinances, permits and regulations which affect his respective trade, and that all costs are included in his proposal.
- B. The Plumbing Contractor and/or Sub-Contractor shall insure all required permits, and assessments have been obtained prior to any work beginning. Contractor shall verify requirement to include privilege fees, plan review fees, and permits as part of his formal bid.
- C. Field Changes:
 1. This Plumbing Contractor shall not make any field changes that affect the system design, equipment manufacturer, timing, costs, or performance without written approval from the Engineer. Approval shall be in the form of a written Field Change Request or Change Order, or supplemental memorandum addressed to the Engineer. All Change Orders shall be directed through the General Contractor and Architect.
 2. The Contractor assumes liability for any additional costs for changes requested. Should any unauthorized change be determined by the Engineer and Architect as lessening the value of the project, a credit will be request, and shall be issued as a change to the contract.

1.06 STANDARDS, CODES, AND PERMITS

- A. Refer to Division 01, General Requirements and Supplementary Conditions.
- B. All work shall comply with the latest edition of applicable standards and codes of following:
 1. ASA - American Standards Association
 2. ASME - American Society of Mechanical Engineers
 3. ASTM - American Society of Testing Materials
 4. ANSI - American National Standards Institute
 5. AGA - American Gas Association
 6. ASHRAE - American Society of Heating, Refrigerating, and Air Conditioning Engineers
 7. AWWA - American Water Works Association
 8. NFPA - National Fire Protection Association
 9. IBR - Institute of Boiler and Radiator Manufacturers

10. AWS - American Welding Society
 11. UL - Underwriter's Laboratories
 12. NEMA - National Electric Manufacturers Association
 13. NEC - National Electric Code
 14. ARA - American Refrigeration Association
 15. OSHA - Occupational Safety and Health Act
 16. ABMA - American Boiler Manufacturers Association
 17. International Mechanical Code 2015
 18. International Plumbing Code 2018 (with Michigan Amendments)
 19. Michigan Mechanical Code 2015
- C. All work shall be provided and tested in accordance with all applicable local county, state laws, ordinances, codes, rules and regulations.
- D. No work shall be covered or enclosed by walls, ceilings, or other, until the work is tested in accordance with applicable codes and regulations, and successful tests witnessed and approved by authorized inspection authority. Written approvals shall be secured by the Plumbing Contractor and submitted to Engineer before final acceptance of work will be granted.

1.07 UTILITY SERVICE REQUIREMENTS

- A. Exterior plumbing services including sanitary drain and storm drain systems beyond 5 feet from the building are covered within the scope of the Civil Engineer on this project.

PART II PRODUCTS

2.01 STANDARDS

- A. All products shall be furnished by established manufacturers regularly engaged in making the type of materials to be provided and complete with all parts, accessories, connections, etc. as specified or as recommended and/or required by the manufacturer.
- B. All material where applicable shall be labeled or listed by Underwriters Laboratories, Inc.
- C. All materials and equipment shall be installed in strict compliance with manufacturer's installation instructions. Where special installations or deviations are required, written approval from the manufacturer is required, and shall not void the manufacturer warranty.

2.02 SUBSTITUTIONS AND CHANGES

- A. The Contractor and/or Equipment Supplier may propose alternate equipment or materials of EQUAL or better quality, function, performance, durability and appearance. This information is to be submitted to the Engineer's Office TEN (10) working days prior to bid due date to allow for proper review time and to issue an addendum incorporating the acceptable substitution(s). It is the submitter's responsibility to provide sufficient material for review as required by Engineer's Office. Acceptance and approval is the responsibility of the Engineer.
- B. The Contractor and/or Equipment Supplier is liable for any added costs to himself or others and is responsible for verifying dimensions, clearance and roughing-in requirements, when product not named as the basis of design are used and is responsible for advising other Contractors of variations and submit revised drawing layout for approval of Engineer.
- C. See SECTION 22 00 10 for voluntary alternates.
1. No substitutions will be accepted after bids are received.
 2. When only one manufacturer is listed within the description of the plumbing fixtures or equipment, the design engineering or project requirements will not allow substitution of other manufacturers.
 3. Contractor will be responsible for ALL costs (engineering time, manufacturer's costs, distributor costs, etc.) incurred to replace equipment not approved if substitutions are made by the distributor, manufacturer's rep., contractor or subcontractor.

- D. Equipment not listed in the Schedules or this Division, or not approved in writing by the Engineer, shall be separated from the Base Bid and shall be listed as a Voluntary Alternate only. Before acceptance, all Voluntary Alternates must be approved by the Engineer and Architect, and must be approved for use by any special Specifications related to the job.
- E. The Plumbing Contractor is responsible and liable for any added costs to themselves or others that may be a result from use of Approved Alternates or Voluntary Alternates.
- F. The Plumbing Contractor is responsible for bidding the Plumbing materials such as pipe and materials as listed on the Drawings and this Division 22 Specification. Alternate materials or value engineering must be pre-approved by the Engineer, prior to bid submittal. Approval of alternate materials must be shared with the Architect, Owner, and other bidders.

2.03 ELECTRICAL REQUIREMENTS AND CONNECTIONS

- A. General:
 - 1. Electrical items furnished shall bear the Underwriter's Laboratories label and the installation shall comply with requirements of the National Electric Code, ANSI, IPCEA, IRI, and local codes, ordinances and regulations.
- B. Motor Starters and Controls:
 - 1. The Electrical Contractor shall provide all manual or magnetic motor starters as required for all motors as indicated on all Electrical Drawings.
 - 2. The Plumbing Contractor shall provide factory installed motor starters integral with packaged equipment containing thermal overcurrent protection in all underground conductors with heater coils selected for specific motor usage for all motors.
- C. Electrical Wiring and Controls:
 - 1. The Plumbing Contractor shall furnish and install all motors, drives, controllers integral to equipment and factory mounted controls for all plumbing equipment.
 - 2. The Electrical Contractor shall install all Class 1 (120 volt and greater) power wiring, conduit to motors and/or factory mounted control panels as indicated on Electrical Drawings or as indicated in Specifications.
 - 3. All electrical wiring work by the Plumbing Contractor shall be in accordance with Division 26 requirements.

PART III EXECUTION

3.01 COORDINATION OF MECHANICAL WORK

- A. Responsibility:
 - 1. The Plumbing Contractor and Sub-Contractors shall be responsible for all parts applicable to the job in accordance with the Specifications and Drawings, and shall be responsible for coordinating locations and arrangements of all Plumbing work with all other relevant Architectural, Structural, Electrical, and fire protection Mechanical Drawings, shop drawings, and Specifications.
- B. Submission of a bid proposal is considered evidence that the Contractor and it's Sub-Contractors are fully capable of providing the following and have included the following in their bid proposal:
 - 1. Fully proficient and experienced to do the work described in the contract documents.
 - 2. Knowledgeable of all federal, state, and local standards, codes, ordinances, permits, and regulations that pertain to the work described in the contract documents.
 - 3. Have properly estimated the time and workforce, including subcontractors, needed to complete the job by the due date.
 - 4. Have included all material, equipment, and labor costs for completion of the job, including all subcontractors costs.
 - 5. Have all the equipment, tools, supplies, vehicles, and trailers to complete the job.
 - 6. Have included all travel, food and lodging expenses.

- C. Installation of Plumbing Systems:
1. Install all Plumbing equipment as shown on the Drawings. Deviations of the Plumbing systems and/or installation locations shall be approved by the Engineer.
 2. Changes or deviations of the Plumbing systems design and/or installation locations may require redrawing and resubmittal of the Drawings to the state or local Plumbing or building inspector.
 3. Any costs associated with re-drawing and resubmittal of the Plumbing Drawings, that did not have pre-approval from the Mechanical Engineer, may be charged to the Plumbing Contractor or subcontractors. All costs shall be based on a time and materials basis.
 4. Minor deviations from the original design will be accepted, but a written request or courtesy call to the Engineer is required. The Engineer may request a written report of the situation and a written request for record.

3.02 EQUIPMENT CLEARANCE

- A. The Plumbing Contractor shall coordinate with the Electrical Contractor's equipment location to ensure adequate clearance is maintained as required by the National Electrical Code and applicable state and local codes, as well as accessibility for future maintenance and operation.
- B. Install equipment in a neat and workmanlike manner. Install, align, and level all equipment so that it may be easily accessed, adjusted, serviced, and balanced.
- C. Install equipment so that valves, and controls may be easily accessed.
- D. Install equipment so that it does not block or limit access to other equipment, access panels, etc.
- E. Install equipment so that it may be easily inspected.

3.03 GENERAL SUPPORTS

- A. Plumbing Contractor shall provide all necessary channel, angle, brackets, vibration isolators, or supplementary steel as required for adequate support for all piping, specialties, ductwork, and equipment which is hung from the ceiling or roof, or mounted to the floor or roof. For equipment requiring welding or bolting to steel framing, or anchoring to concrete structures, the Plumbing Contractor shall require written approval from the Architect and General Contractor.
- B. Where piping or equipment is suspended from concrete construction, coordinate with the General Contractor to set approved concrete inserts, that shall receive hanger rods such as UniStrut in the concrete form-work. In metal decks, coordinate with General Contractor to use Ramset or welds as required.

3.04 WALL, FLOOR, CEILING, AND ROOF OPENINGS

- A. Locate all openings and advise the General Contractor of details and templates of all openings necessary for inspection of Plumbing work.
- B. All openings including sawcuts, cores, and required lintels shall be provided by the General Contractor, and shall be approved by the Architect and Structural Engineer. Size and location are the responsibility of the Plumbing Contractor. Cracks and rough edges left following installation of equipment shall be caulked, fire-caulked if required, or filled by the Mechanical Contractor.
- C. Perform or pay for all cutting, fitting, repairing, patching and finishing of work of other sections where it is necessary to disturb such work to permit installation of mechanical work.
- D. All roof openings including sawcuts and cores through the roof deck shall be provided by the General Contractor, and shall be approved by the Architect and Structural Engineer. Size and location of the openings are the responsibility of the Plumbing Contractor.
- E. All roof curbs, Pate Curbs, or other specialty curbs shall be the responsibility of the Plumbing Contractor. Specialty roof curb flashings or curb-membranes shall be included.

- F. All roofing materials including standard flashing, and the installation of roofing systems around the Plumbing equipment shall be the responsibility of the General Contractor.
- G. All roof deck supporting materials including angles, joists, etc., shall be the responsibility of the General Contractor, and shall be approved by the Architect and Structural Engineer.

3.05 FIELD CHANGES

- A. The Plumbing Contractor shall not make any field changes that affect the system design, equipment manufacturer, timing, costs, or performance without written approval from the Engineer. Approval shall be in the form of a written Field Change Request or Change Order, or Supplemental Instruction. All Change Orders shall be directed through the General Contractor and Architect.
- B. The Contractor assumes liability for any additional costs for changes requested. Should any unauthorized change be determined by the Engineer and Architect as lessening the value of the project, a credit will be request, and shall be issued as a change to the contract.

3.06 PROJECT CLOSE-OUT

- A. Final Acceptance and payment will only be made after final Punch-List completion and receipt at the Engineer's Office of:
 - 1. Approved Operating and Maintenance Instruction Manuals
 - 2. Approved Record Drawings (As-Built)
 - 3. All Guarantees/Warranties
 - 4. Certificates of Inspection
 - 5. Written and signed verification that Owner's Training has taken place
 - 6. All extra materials specified to be provided within the Contract Documents

3.07 CERTIFICATES OF INSPECTION

- A. Submit to the Engineer's Office evidence that installation has been inspected and approved by local or state mechanical inspector and/or the authority having jurisdiction.

3.08 GUARANTEES AND WARRANTIES

- A. All labor, materials and equipment shall be guaranteed by Contractor and/or warranted by Manufacturer for ONE (1) year after acceptance date except where specified longer for special equipment. Contractor shall secure such warranty from all Suppliers (not one year from shipment date) or Contractor to assume warranty.
- B. Acceptance date of substantial completion shall be Owner occupancy as determined by Architect/Engineer.
- C. Contractor shall make all necessary alterations, repairs, adjustments, replacements during guarantee periods as directed by Architect/Engineer to comply with Drawings and Specifications at no cost to Owner.
- D. Repair or replacements made under guarantee bear further ONE (1) year guarantee from date of acceptance of repair or replacement.
- E. At the end of a one year period of continuous operation, make a complete inspection of all systems, fixtures, equipment, safety devices and controls to insure equipment is operating properly, and report to Engineer in writing.

3.09 PLACING EQUIPMENT INTO OPERATION

- A. Contractor shall be responsible for all startup procedures, system checks and balancing associated with his equipment.
- B. All equipment shall be installed, tested and operated in accordance with manufacturer's recommendations at normal operating conditions.
- C. All permanent plumbing equipment operated during construction periods shall be cleaned and damaged equipment replaced.

3.10 OWNER'S TRAINING

- A. The Plumbing Contractor shall conduct ONE (1) - 2-hour training session(s) on the operation and maintenance of all plumbing equipment. Schedule training with Owner at least 72 hours prior to session(s).

END OF SECTION

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**SECTION 22 00 10
PLUMBING EQUIPMENT AND MATERIALS**

PART 1 GENERAL

1.01 INSTRUCTION:

- A. The Plumbing Contractor is to either copy or remove this specification section from the spec book and complete as follows:
 - 1. Indicate the specific manufacturer on which the bidder's base bid price is based in the blank space provided.
 - 2. All equipment is to be bid as specified. Material or equipment from another manufacturer may be bid as a Voluntary Alternate, but the dollar amount must be shown as an "Add" or "Deduct" to the base bid. Provide the name of the alternate manufacturer in the space provided.
 - 3. Insert the name(s) of each subcontractor used in your bid in the space provided in Part 3.
 - 4. This form shall be submitted with the bid.

1.02 RELATED DOCUMENTS:

- A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this section.

1.03 DEVIATIONS FROM SPECIFIED MATERIAL:

- A. See SECTION 22 00 00, Part 2, Paragraph 2.02 - Substitutions and Changes. Base bid shall be based on manufacturers listed in this specification or on the drawings.

PART 2 PRODUCTS

2.01 THE FOLLOWING IS A LIST OF APPROVED MANUFACTURERS, GROUPED ACCORDING TO TYPES OF MATERIALS OR EQUIPMENT.

- A. Hose Bibb(s):
 - 1. Woodford, Shier.
 - a. Voluntary Alternate _____
 - b. Add \$ Deduct \$ _____

PART 3 SUB-CONTRACTORS

3.01 INSERT THE NAME OF EACH SUB-CONTRACTOR AND WORK TO BE PERFORMED BELOW:

- A. Subcontractor Work Performed:
- B. Subcontractor Work Performed
- C. Subcontractor Work Performed

END OF SECTION

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SECTION 22 05 17
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe sleeves.
- B. Manufactured sleeve-seal systems.

1.02 QUALITY ASSURANCE

- A. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

- A. Vertical Piping:
 - 1. Sleeve Length: 1 inch (25 mm) above finished floor.
 - 2. Provide sealant for watertight joint.
 - 3. Blocked Out Floor Openings: Provide 1-1/2 inch (40 mm) angle set in silicon adhesive around opening.
 - 4. Drilled Penetrations: Provide 1-1/2 inch (40 mm) angle ring or square set in silicone adhesive around penetration.
- B. Pipe Passing Through Below Grade Exterior Walls:
 - 1. Zinc coated or cast iron pipe.
 - 2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- C. Clearances:
 - 1. Provide allowance for insulated piping.
 - 2. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

2.02 MANUFACTURED SLEEVE-SEAL SYSTEMS

- A. Modular/Mechanical Seal:
 - 1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
 - 2. Provide watertight seal between pipe and wall/casing opening.
 - 3. Elastomer element size and material in accordance with manufacturer's recommendations.
 - 4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

- A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- B. Install piping to conserve building space, to not interfere with use of space and other work.

- C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- D. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 4. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- E. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
 - 1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
 - 2. Aboveground Piping:
 - a. Pack solid using mineral fiber complying with ASTM C592.
 - b. Fill space with an elastomer caulk to a depth of 0.50 inch (15 mm) where penetrations occur between conditioned and unconditioned spaces.
 - 3. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.
 - 4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.
- F. Manufactured Sleeve-Seal Systems:
 - 1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
 - 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
 - 3. Locate piping in center of sleeve or penetration.
 - 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
 - 5. Tighten bolting for a water-tight seal.
 - 6. Install in accordance with manufacturer's recommendations.
- G. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 CLEANING

- A. Upon completion of work, clean all parts of the installation.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.
- D. Ceiling tacks.

1.02 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

1.03 SUBMITTALS

- A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- B. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Major Control Components: Nameplates.
- B. Piping: Pipe markers.
- C. Pumps: Nameplates.
- D. Equipment: Nameplates.
- E. Tanks: Nameplates.
- F. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.02 NAMEPLATES

- A. Manufacturers:
 - 1. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 - 3. Seton Identification Products: www.seton.com/#sle.
- B. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/2 inch (13 mm).
 - 3. Background Color: Black.
 - 4. Plastic: Comply with ASTM D709.

2.03 TAGS

- A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.
- B. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.
- C. Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

- A. Manufacturers:
 - 1. Brady Corporation: www.bradycorp.com/#sle.
 - 2. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.

4. Seton Identification Products: www.seton.com/#sle.
- B. Comply with ASME A13.1.
- C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- E. Color code as follows:
 1. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.
 2. Flammable Fluids: Yellow with black letters.
 3. Compressed Air: Blue with white letters.

2.05 CEILING TACKS

- A. Description: Steel with 3/4 inch (20 mm) diameter color coded head.
- B. Color code as follows:
 1. Plumbing Valves: Green.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Use tags on piping 3/4 inch (20 mm) diameter and smaller.
 1. Identify service, flow direction, and pressure.
 2. Install in clear view and align with axis of piping.
 3. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- F. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch (20 mm) diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

**SECTION 22 07 19
PLUMBING PIPING INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.
- B. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.
- C. Section 23 21 13 - Hydronic Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019, with Editorial Revision (2023).
- D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2023.
- E. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2022a.
- F. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

2.02 GLASS FIBER

Manufacturers:

- 1. Knauf Insulation; _____: www.knaufusa.com.
- 2. Johns Manville Corporation; Model _____: www.jm.com.
- 3. Owens Corning Corp; Model _____: www.owenscorning.com.
- 4. CertainTeed Corporation; _____: www.certainteed.com.

5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
 1. K (Ksi) Value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
 2. Maximum Service Temperature: 850 degrees F (454 degrees C).
 3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches (0.029 ng/Pa s m).
- D. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturers:
 1. Armacell LLC; AP Armaflex: www.armacell.us/#sle.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
 1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
 2. Maximum Service Temperature: 220 degrees F (104 degrees C).
 3. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.04 JACKETS

PVC Plastic.

1. Manufacturers:
 - a. Johns Manville Corporation; _____: www.jm.com/#sle.
2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F (Minus 18 degrees C).
 - b. Maximum Service Temperature: 150 degrees F (66 degrees C).
 - c. Moisture Vapor Permeability: 0.002 perm inch (0.0029 ng/Pa s m), maximum, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil (0.25 mm).
 - e. Connections: Brush on welding adhesive.
3. Covering Adhesive Mastic: Compatible with insulation.
 - a. Compatible with insulation.
- B. Canvas Jacket: UL listed 6 oz/sq yd (220 g/sq m) plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
 1. Lagging Adhesive: Compatible with insulation.
 - a. Compatible with insulation.
- C. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
 1. Thickness: 0.016 inch (0.40 mm) sheet.
 2. Finish: Smooth.
 3. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
 4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

- B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass fiber insulated pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. For hot piping conveying fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- G. Glass fiber insulated pipes conveying fluids above ambient temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- H. Inserts and Shields:
 - 1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.
 - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - 3. Insert Location: Between support shield and piping and under the finish jacket.
 - 4. Insert Configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
- I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.
- J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet (3 meters) above finished floor): Finish with canvas jacket sized for finish painting.

3.03 SCHEDULES

- A. Plumbing Systems:
 - 1. Domestic Hot Water Supply:
 - a. Cellular Melamine Foam Insulation:
 - 1) Pipe Size Range: 1/2 - 1-1/4 inch (____ mm).
 - 2) Thickness: 1-1/2 inch (____ mm).
 - b. Glass Fiber Insulation:
 - 1) Pipe Size Range: 1/2" - 1-1/4", thickness: 1-inch.
 - 2) Pipe Size Range: 1-1/2"+, thickness: 1-1/2 inch.
 - 2. Domestic Cold Water:
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range: 1/2" - 1-1/4", thickness: 1-inch.
 - 2) Pipe Size Range: 1-1/2"+, thickness: 1-1/2 inch.
 - 3. Condensate Piping:
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range: All sizes.
 - 2) Thickness: 1/2 inch.

- B. Heating Systems:
 - 1. Heating Hot Water Supply and Return Piping:
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range: All sizes.
 - 2) Thickness: 1 inch.
 - 2. Exposed Heating Hot Water Supply and Return Piping:
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range: All sizes.
 - 2) Thickness: 1 inch.
 - b. PVC Jacket
 - 3. Domestic Hot Water Recirculation:
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range: All sizes.
 - 2) Thickness: 1 inch (25 mm).

END OF SECTION

**SECTION 22 10 05
PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe, pipe fittings, specialties, and connections for piping systems.
 - 1. Sanitary sewer.
 - 2. Domestic water.
 - 3. Flanges, unions, and couplings.
 - 4. Pipe hangers and supports.
 - 5. Ball valves.
 - 6. Check.
 - 7. Water pressure reducing valves.
 - 8. Relief valves.

1.02 REFERENCE STANDARDS

- A. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems 2015 (Reaffirmed 2020).
- B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.
- C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
- D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.
- E. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes 2018.
- F. ASME B31.1 - Power Piping 2022.
- G. ASME B31.9 - Building Services Piping 2020.
- H. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers 2023.
- I. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2023.
- J. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Potable Water Distribution Systems 2020.
- K. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2022).
- L. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- M. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings 2021.
- N. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2023.
- O. ASTM B32 - Standard Specification for Solder Metal 2020.
- P. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2022.
- Q. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.
- R. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube 2016.
- S. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings 2016.
- T. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Inside Diameter 2022.

- U. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40 2021.
- V. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings 2020.
- W. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems 2020.
- X. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe 2021.
- Y. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings 2020.
- Z. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing 2020.
- AA. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2021.
- BB. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets 2020.
- CC. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2021.
- DD. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing 2023.
- EE. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-Linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing 2023a.
- FF. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2018.
- GG. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings 2017.
- HH. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast 2017, with Errata (2018).
- II. AWWA C606 - Grooved and Shouldered Joints 2022.
- JJ. AWWA C651 - Disinfecting Water Mains 2014, with Addendum (2020).
- KK. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2021.
- LL. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2020.
- MM. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- NN. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves 2019.
- OO. MSS SP-85 - Gray Iron Globe and Angle Valves, Flanged and Threaded Ends 2011.
- PP. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .
- QQ. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- RR. NSF 372 - Drinking Water System Components - Lead Content 2022.
- SS. PPI TR-4 - PPI HSB Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe 2021.

1.03 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Michigan plumbing code.
- B. Conform to applicable code for installation of backflow prevention devices.
- C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices. work in accordance with applicable codes.
- D. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

- A. PVC Pipe: ASTM D2665 or ASTM D3034.
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.04 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: ASTM B32, alloy Sn95 solder.

2.05 NATURAL GAS PIPING, BURIED BEYOND 5 FEET (1500 MM) OF BUILDING

- A. Polyethylene Pipe: ASTM D2513, SDR 11.
 - 1. Fittings: ASTM D2683 or ASTM D2513 socket type.
 - 2. Joints: Fusion welded.

2.06 NATURAL GAS PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
 - 1. Fittings: ASTM A234/A234M, wrought steel welding type.
 - 2. Joints: ASME B31.1, welded.
 - 3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil (0.25 mm) polyethylene tape.

2.07 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
 - 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
 - 2. Joints: Threaded or welded to ASME B31.1.

2.08 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 - 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 - 3. Trapeze Hangers: Welded steel channel frames attached to structure.
 - 4. Vertical Pipe Support: Steel riser clamp.

2.09 BALL VALVES

- A. Manufacturers:
 - 1. Conbraco Industries, Inc: www.apollovalves.com.
 - 2. Grinnell Products; ____: www.grinnell.com/#sle.
 - 3. Nibco, Inc: www.nibco.com.
 - 4. Milwaukee Valve Company: www.milwaukeevalve.com.
- B. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, threaded or grooved ends with union.

2.10 BALL VALVES

- A. Manufacturers:
 - 1. Conbraco Industries, Inc: www.apollovalves.com.
 - 2. Grinnell Products; ____: www.grinnell.com/#sle.
 - 3. Nibco, Inc: www.nibco.com.
 - 4. Milwaukee Valve Company: www.milwaukeevalve.com.
- B. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder, threaded, or grooved ends.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.

- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 22 05 16.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed.
- I. Provide support for utility meters in accordance with requirements of utility companies.
- J. Install valves with stems upright or horizontal, not inverted. See Section 22 05 23.
- K. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- L. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- M. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9.
 - 2. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
 - 3. Place hangers within 12 inches (300 mm) of each horizontal elbow.
 - 4. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 5. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- N. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.04 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.05 TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch (10 mm) vertically of location indicated and slope to drain at minimum of 1/8 inch per foot (1:100) slope.
- B. Water Piping: Slope at minimum of 1/32 inch per foot (1:400) and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect water distribution system in accordance with Section 33 01 10.58.
- B. Prior to starting work, verify system is complete, flushed, and clean.
- C. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- D. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.
- E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- F. Maintain disinfectant in system for 24 hours.
- G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

- I. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SERVICE CONNECTIONS

- A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 14 inch wg (. kPa). Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

3.08 SCHEDULES

- A. Pipe Hanger Spacing:
 1. Metal Piping:
 - a. Pipe Size: 1/2 inches (15 mm) to 1-1/4 inches (32 mm):
 - 1) Maximum Hanger Spacing: 6.5 ft (2 m).
 - 2) Hanger Rod Diameter: 3/8 inches (9 mm).
 - b. Pipe Size: 1-1/2 inches (40 mm) to 2 inches (50 mm):
 - 1) Maximum Hanger Spacing: 10 ft (3 m).
 - 2) Hanger Rod Diameter: 3/8 inch (9 mm).
 - c. Pipe Size: 2-1/2 inches (65 mm) to 3 inches (75 mm):
 - 1) Maximum Hanger Spacing: 10 ft (3 m).
 - 2) Hanger Rod Diameter: 1/2 inch (13 mm).
 2. Plastic Piping:
 - a. All Sizes:
 - 1) Maximum Hanger Spacing: 6 ft (1.8 m).
 - 2) Hanger Rod Diameter: 3/8 inch (9 mm).

END OF SECTION

**SECTION 22 10 06
PLUMBING PIPING SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Drains.
- B. Cleanouts.
- C. Hose bibbs.
- D. Backflow preventers.
- E. Sanitary waste interceptors.
- F. Catch basins.
- G. Exterior penetration accessories.
- H. Water hammer arrestors.

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers 2017.
- C. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies 2021.
- D. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections 2019.
- E. ASTM C478M - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections (Metric) 2019.
- F. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- G. NSF 372 - Drinking Water System Components - Lead Content 2022.
- H. PDI-WH 201 - Water Hammer Arresters 2017.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 FLOOR DRAIN :

- 1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

2.03 CLEANOUTS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company; _____: www.jayrsmith.com.
 - 2. Josam Company; _____: www.josam.com.

3. Zurn Industries, LLC; _____: www.zurn.com.
- B. Cleanouts at Exterior Unsurfaced Areas (CO-2):
 1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.
- C. Cleanouts at Interior Finished Floor Areas (CO-3):
 1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.
- D. Cleanouts at Interior Unfinished Accessible Areas (CO-5): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.04 HOSE BIBBS

- A. Manufacturers:
 1. Jay R. Smith Manufacturing Company; _____: www.jayrsmith.com.
 2. Murdock Manufacturing, Inc; _____: www.murdockmfg.com.
 3. Zurn Industries, LLC; _____: www.zurn.com.
 4. Woodford.

2.05 BACKFLOW PREVENTERS

- A. Reduced Pressure Backflow Preventers:
 1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.06 SANITARY WASTE INTERCEPTORS

- A. Manufacturers:
 1. Striem.

2.07 WATER HAMMER ARRESTORS

- A. Manufacturers:
 1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
 2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com.
 3. Zurn Industries, LLC: www.zurn.com.
- B. Water Hammer Arrestors:
 1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F (minus 73 to 149 degrees C) and maximum 250 psi (1700 kPa) working pressure.

2.08 MIXING VALVES

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Pipe relief from backflow preventer to nearest drain.

- F. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks or washing machine outlets.

END OF SECTION

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SECTION 22 1426.19
FACILITY TRENCH DRAINS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Trench drain systems.

1.2 RELATED SECTIONS

- A. Section 03 3000 – Case-In-Place Concrete

1.3 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM A 123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 2. ASTM A 536 - Standard Specification for Ductile Iron Castings.
 - 3. ASTM C267 – Standard for chemical resistance
 - 4. ASTM C307 – Standard for tensile strength
 - 5. ASTM C579 – Standard for compressive strength
 - 6. ASTM C580 – Standard for flexural strength
 - 7. ASTM D570 – Standard for water absorption

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings:
- D. Verification Samples: For each finish product specified, two samples, minimum size 24 inches square representing actual product and finish.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 5 year experience manufacturing similar products.
- B. Installer Qualifications: Minimum 2 year experience installing similar products.

1.6 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to starting work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
- C. Handle materials to avoid damage.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.9 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.10 WARRANTY

- A. Warranty: Provide manufacturer's standard limited warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Eric'sons Inc., 574 Industrial Way N, Dallas, GA 30132, USA. ASD. Tel: (770) 505-6575. Email: info@eric-sons.com. Web: <http://www.duratrench.com>.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 SYSTEM DESCRIPTION

- A. Provide grates and frames as indicated on the drawings.

2.3 COMPONENTS

- A. Frame:
 - 1. HDSPGS15ZSA - Heavy duty galvanized steel.
 - 2. Accepts 1-1/2" thick grates.
- B. Grate Locking:
 - 1. GL4B - Four corner bolt down of grates (where applicable)
- C. Joint Sealant:
 - 1. NSR - No joint sealant is required for this application.

2.4 26 INCHES GRATE

- A. Size: 26 inches wide x 24 inches long x 1.5 inches thick unless noted.
- B. Model 26AF24GSD: Galvanized heavy-duty solid cover plate
 - 1. The grate shall be fabricated from A36 steel. The cover shall be hot dip galvanized per ASTM A-123.
 - 2. Provide checkered tread plate.
 - 3. The cover shall have a minimum load rating of DIN Class D (exceeds H-20/HS-25).
 - 4. Four-corner bolt-down or locking type.
- C. Model 26B24DGF: Galvanized ductile iron slotted grate.
 - 1. Grating shall be 26B24DGF extreme duty slotted grate with four corner lock down. The grate shall be made of grade 65-45-12 cast ductile iron conforming to ASTM A 536-84.
 - 2. The grate shall be hot dip galvanized per ASTM A-123.
 - 3. The grate shall exceed FAA AC150/5 320-6E appendix 3 load, AASHTO M306-9 grate/manhole proof test, and be AASHTO H-25 rated, DIN Class D.
 - 4. Four-corner bolt-down or locking type.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Ensure any reinforcement is placed and firmly held in place prior to linear drain installation. All reinforcement steel shall follow concrete reinforcing steel institute standards.

- B. Prepare linear drain frames and grates by ensuring they are clean and properly oriented and sequenced.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction.
- B. Place concrete to anchor grate frame as shown in contract documents. The drain shall be finished 1/8" below finish grade while ensuring proper slope of adjacent areas toward the drain creating positive flow to the drain.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Clean and remove any debris from linear drains prior to Owner's acceptance.
- C. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 23 00 00
MECHANICAL GENERAL PROVISIONS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. This Division includes all materials, labor, equipment, tools, supervision, permits, and incidentals necessary to complete installation and successfully test, start-up, and operate, in a practical and efficient manner, all mechanical systems indicated on the Mechanical Drawings and described in this Division. The work shall also include any items which, while not specifically included in the Contract Documents, are reasonable and are accepted trade practices or necessary for the proper completion of the systems.
- B. Mechanical systems in the contract shall include the following:
 - 1. Plumbing systems including:
 - a. Domestic potable hot water, cold water, sanitary drain, and storm drain systems.
 - b. Plumbing fixtures, piping, and insulation indicated in the Drawings and Specifications.
 - 2. Heating, ventilation, and air-conditioning (HVAC) systems including all equipment ductwork, piping, insulation, and temperature control systems indicated in the Drawings and the Specifications.
- C. The General Provisions of this Contract, including General and Supplementary Conditions and other General Requirements specified in the Architectural, Electrical, Structural, and Fire Protection Specifications apply to the work specified in this Section.
- D. This section is not intended to supersede, but to clarify the definitions in Division 01, General Requirements.
- E. **Additional Work Scope: The Mechanical Contractor shall coordinate and assist the Owner to complete the necessary documentation for obtaining all applicable energy efficiency Utility rebates for the work and equipment specified in this project.**

1.02 DRAWINGS AND SPECIFICATIONS

- A. Drawings are diagrammatic and are intended to convey a general arrangement and scope of the work included in the contract. Should drawings contradict themselves or the Specifications, the better quality or greater quantity of work shall be included.
- B. The Mechanical Contractor shall be familiar with all Architectural, Structural, Fire Protection, and Electrical Drawings and Specification Sections, and shall follow any special requirements or directions included in these areas.
- C. Drawings and Specifications are intended to include all work and materials necessary for completion of the work. Any incidental item of material, labor or detail required for the proper execution and completion of the work and omitted from either the drawings and specifications or both, but required by governing codes local regulations, trade practices, operational functions, and good workmanship, shall be provided as part of the Contract Work without extra charge, even though not specifically detailed or specified.
- D. Should there be any question as to the scope of work for which the Mechanical Contractor is responsible, they should request an interpretation before submitting their bid. After contracts are awarded, the Owner shall not be responsible for claims for extras for work that was not included because the Mechanical Contractor was unsure if they should include given work in their bid.

1.03 SITE AND PROJECT DOCUMENT EXAMINATION

- A. Submission of a bid proposal is considered evidence that the Mechanical Contractor has completed the following:
 - 1. Visited the site.
 - 2. Informed themselves of the site conditions.

3. Examined Drawings and Specifications of all trades including Architectural, Structural and Electrical, and is proficient, experienced and knowledgeable of all standards, codes, ordinances, permits and regulations which affect his respective trade, and that all costs are included in his proposal.
- B. The Mechanical Contractor and/or Sub-Contractor shall insure all required permits, and assessments have been obtained prior to any work beginning. Contractor shall verify requirement to include privilege fees, plan review fees, and permits as part of his formal bid.
- C. Field Changes:
 1. This Mechanical Contractor shall not make any field changes that affect the system design, equipment manufacturer, timing, costs, or performance without written approval from the Mechanical and Plumbing Engineer. Approval shall be in the form of a written Field Change Request or Change Order, or supplemental memorandum addressed to the Engineer. All Change Orders shall be directed through the Construction Manager and Architect.
 2. The Contractor assumes liability for any additional costs for changes requested. Should any unauthorized change be determined by the Engineer and Architect as lessening the value of the project, a credit will be request, and shall be issued as a change to the contract.

1.04 STANDARDS, CODES, AND PERMITS

- A. Refer to Division 01, General Requirements and Supplementary Conditions.
- B. All work shall comply with the latest edition of applicable standards and codes of following:
 1. ASA - American Standards Association
 2. ASME - American Society of Mechanical Engineers
 3. ASTM - American Society of Testing Materials
 4. ANSI - American National Standards Institute
 5. AGA - American Gas Association
 6. ASHRAE - American Society of Heating, Refrigerating, and Air Conditioning Engineers
 7. AWWA - American Water Works Association
 8. NFPA - National Fire Protection Association
 9. IBR - Institute of Boiler and Radiator Manufacturers
 10. AWS - American Welding Society
 11. UL - Underwriter's Laboratories
 12. NEMA - National Electric Manufacturers Association
 13. NEC - National Electric Code
 14. ARA - American Refrigeration Association
 15. OSHA - Occupational Safety and Health Act
 16. ABMA - American Boiler Manufacturers Association
 17. International Mechanical Code 2012
 18. International Plumbing Code 2012 (with Michigan Ammendments)
 19. Michigan Mechanical Code 2012
- C. All work shall be provided and tested in accordance with all applicable local county, state laws, ordinances, codes, rules and regulations.
- D. No work shall be covered or enclosed by walls, ceilings, or other, until the work is tested in accordance with applicable codes and regulations, and successful tests witnessed and approved by authorized inspection authority. Written approvals shall be secured by the Mechanical Contractor and submitted to Engineer before final acceptance of work will be granted.

1.05 SUBMITTALS

- A. Proposal Supplement:
 - 1. Contractor to submit ONE (1) copy of Proposal Supplement - SECTION 23 00 10 - MECHANICAL EQUIPMENT AND MATERIALS, at the time of Bid opening, listing the manufacturers upon which his bid was based, including all items being provided by Sub-Contractors.
 - 2. After Proposal Supplement and Sub-Contractors are approved, no deviation shall be permitted without written approval of Engineer.
- B. Shop Drawings:
 - 1. Contractor shall electronically submit shop drawings on all equipment and materials indicated on the Drawings for approval, prior to placing delivery orders (also refer to Architectural Specifications for shop drawing requirements).
 - 2. At the time of submittal for review by the Engineer, shop drawings shall include signatures or stamps indicating that the Contractor and/or the Sub-Contractor has reviewed the submittals and has coordinated the required space, quantities required, services and work of other trades for the equipment or system being submitted.
 - 3. Provide shop drawings of all manufactured equipment and materials except pipe, pipe fittings and galvanized ductwork. Drawings shall include equipment capacities, weights, dimensions, construction details, installation, controls, wiring diagrams, and motor data.
 - 4. Engineer's approval of shop drawings is for general application only and is a service only and not considered as a guarantee of total compliance with or as relieving the Mechanical Contractor of basic responsibilities under all contract documents, and does not approve changes in time or cost.
 - 5. After approval, the Mechanical Contractor and it's subcontractors are responsible to provide information to all other trades involved in, or affected by, the installation of the Mechanical and Plumbing equipment.
- C. Operating and Maintenance Manuals:
 - 1. The Mechanical Contractor and subcontractors shall provide TWO (2) bound and indexed (with tabs for each section) sets of operating and maintenance instructions to the Engineer for review as part of the Final Punch List/Close-out. The Engineer will provide approved manuals to the Owner.
 - 2. These manuals shall be in accordance with industry-accepted standards and shall include, at the minimum:
 - a. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
 - b. Operation and Maintenance manuals for each piece of equipment requiring maintenance. Required routine maintenance actions shall be clearly identified.
 - c. Names and addresses of at least one (1) service agency.
 - d. HVAC controls system maintenance and calibration information, including:
 - 1) Wiring diagrams
 - 2) Control schematics
 - 3) Control sequence of operation descriptions
 - e. HVAC control drawings with desired or field-determined set points permanently recorded and indicated.
 - f. A complete narrative of how each system is intended to operate, including suggested set points.

1.06 MECHANICAL UTILITY SERVICE REQUIREMENTS

- A. Exterior plumbing services including sanitary drain and storm drain systems beyond 5 feet from the building are covered within the scope of the Civil Engineer on this project.

- B. Natural Gas Service
 - 1. The Mechanical Contractor shall arrange with the Utility Company to provide gas service and a gas meter to the location shown on the Mechanical Drawings, complete with a shut-off valve at the meter.
 - 2. The Mechanical Contractor shall consult with the Utility Company as to the extent of its work.

PART II PRODUCTS

2.01 STANDARDS

- A. All products shall be furnished by established manufacturers regularly engaged in making the type of materials to be provided and complete with all parts, accessories, connections, etc. as specified or as recommended and/or required by the manufacturer.
- B. All material where applicable shall be labeled or listed by Underwriters Laboratories, Inc.
- C. All materials and equipment shall be installed in strict compliance with manufacturer's installation instructions. Where special installations or deviations are required, written approval from the manufacturer is required, and shall not void the manufacturer warranty.

2.02 SUBSTITUTIONS AND CHANGES

- A. The Contractor and/or Equipment Supplier may propose alternate equipment or materials of EQUAL or better quality, function, performance, durability and appearance. This information is to be submitted to the Engineer's Office TEN (10) working days prior to bid due date to allow for proper review time and to issue an addendum incorporating the acceptable substitution(s). It is the submitter's responsibility to provide sufficient material for review as required by Engineer's Office. Acceptance and approval is the responsibility of the Engineer.
- B. The Contractor and/or Equipment Supplier is liable for any added costs to himself or others and is responsible for verifying dimensions, clearance and roughing-in requirements, when product not named as the basis of design are used and is responsible for advising other Contractors of variations and submit revised drawing layout for approval of Engineer.
- C. See SECTION 23 00 10 and individual equipment Specifications for approved equipment manufacturers.
 - 1. No substitutions will be accepted after bids are received.
 - 2. When only one manufacturer is listed within the description of the mechanical equipment, the design engineering or project requirements will not allow substitution of other manufacturers.
 - 3. Contractor will be responsible for ALL costs (engineering time, manufacturer's costs, distributor costs, etc.) incurred to replace equipment not approved if substitutions are made by the distributor, manufacturer's rep., contractor or subcontractor.
- D. Voluntary Alternates will not be accepted on this project.
- E. The Mechanical Contractor is responsible and liable for any added costs to themselves or others that may be a result from use of Approved Manufacturer's products.
- F. The Mechanical Contractor is responsible for bidding the Mechanical and Plumbing materials such as pipe and ductwork materials as listed on the Mechanical Drawings and Divisions 22 & 23 Specifications. Alternate materials or value engineering must be pre-approved by the Engineer, prior to bid submittal. Approval of alternate materials must be shared with the Architect, Owner, and other bidders.

2.03 ELECTRICAL REQUIREMENTS AND CONNECTIONS

- A. General:
 - 1. When the Mechanical equipment not named as the basis of design is approved for use, the Mechanical Contractor is responsible for any costs incurred by other trades, including

- revisions to the Electrical requirements such as conduit, wire, starters, heaters, fused switches, disconnects, or circuit breakers.
2. Electrical items furnished shall bear the Underwriter's Laboratories label and the installation shall comply with requirements of the National Electric Code, ANSI, IPCEA, IRI, and local codes, ordinances and regulations.
- B. Motor Starters and Controls:
1. The Electrical Contractor shall provide all manual or magnetic motor starters as required for all motors as indicated on all Electrical Drawings.
 2. The Mechanical Contractor shall provide factory installed motor starters integral with packaged equipment containing thermal overcurrent protection in all underground conductors with heater coils selected for specific motor usage for all motors.
- C. Electrical Wiring and Controls:
1. The Mechanical Contractor shall furnish and install all motors, drives, controllers integral to equipment and factory mounted controls for all mechanical equipment.
 2. The Mechanical Contractor or Temperature Control Contractor shall furnish and install all electrical devices requiring mechanical connections, and/or electrical connections, such as thermostats, UL rated temperature control cabinets, etc., as listed in the Division 23 Contract Documents.
 3. The Temperature Control Contractor or Mechanical Contractor shall furnish and install all power and Class 2 and 3 wiring (low voltage), conduit, and electrical boxes associated with the Temperature Control System. Verify with Mechanical and Electrical Engineer whether plenum-rated, low voltage wiring is required. **The TCC shall be responsible for ANY Class 1 power wiring required to meet the specified sequence of operations. No additional costs will be provided to the contractor for wiring and components required by other trades to allow the temperature controls system to function as specified.**
 4. The Electrical Contractor shall install all Class 1 (120 volt and greater) power wiring, conduit to motors and/or factory mounted control panels as indicated on Electrical Drawings or as indicated in Specifications.
 5. All electrical wiring work by the Mechanical Contractor and Temperature Control Contractor shall be in accordance with Division 26 requirements.

PART III EXECUTION

3.01 COORDINATION OF MECHANICAL WORK

- A. Responsibility:
1. The Mechanical Contractor shall be responsible for all Sub-Contractors and Suppliers, and include in his bid all materials, labor and equipment involved in accordance with all local regulations, jurisdictional awards, decisions, and secure compliance of all parts of the Specifications and Drawings regardless of sectional inclusion in these Specifications.
 2. The Mechanical Contractor and Sub-Contractors shall be responsible for all parts applicable to the job in accordance with the Specifications and Drawings, and shall be responsible for coordinating locations and arrangements of all Mechanical and Plumbing work with all other relevant Architectural, Structural, Electrical, and fire protection Mechanical Drawings, shop drawings, and Specifications.
- B. Submission of a bid proposal is considered evidence that the Mechanical Contractor and its Sub-Contractors are fully capable of providing the following and have included the following in their bid proposal:
1. Fully proficient and experienced to do the work described in the contract documents.
 2. Knowledgeable of all federal, state, and local standards, codes, ordinances, permits, and regulations that pertain to the work described in the contract documents.
 3. Have properly estimated the time and workforce, including subcontractors, needed to complete the job by the due date.

4. Have included all material, equipment, and labor costs for completion of the job, including all subcontractors costs.
 5. Have all the equipment, tools, supplies, vehicles, and trailers to complete the job.
 6. Have included all travel, food and lodging expenses.
- C. Installation of Mechanical Systems:
1. Install all Mechanical equipment as shown on the Mechanical Drawings. Deviations of the Mechanical systems and/or installation locations shall be approved by the Engineer.
 2. Changes or deviations of the Mechanical systems design and/or installation locations may require redrawing and resubmittal of the Mechanical Drawings to the state or local Mechanical or building inspector.
 3. Any costs associated with re-drawing and resubmittal of the Mechanical and Plumbing Drawings, that did not have pre-approval from the Mechanical Engineer, may be charged to the Mechanical Contractor or Mechanical subcontractors. All costs shall be based on a time and materials basis.
 4. Minor deviations from the original design will be accepted, but a written request or courtesy call to the Engineer is required. The Engineer may request a written report of the situation and a written request for record.

3.02 EQUIPMENT CLEARANCE

- A. The Mechanical Contractor shall coordinate with the Electrical Contractor's equipment location to insure adequate clearance is maintained as required by the National Electrical Code and applicable state and local codes, as well as accessibility for future maintenance and operation.
- B. Mechanical work shall be arranged with building construction to provide minimum 6'-8" overhead clearance where possible.
- C. Install equipment in a neat and workmanlike manner. Install, align, and level all Mechanical equipment so that it may be easily accessed, adjusted, serviced, and balanced.
- D. Install equipment so that filters, valves, and controls may be easily accessed.
- E. Install equipment so that it does not block or limit access to other equipment, access panels, etc.
- F. Install equipment so that it may be easily inspected.

3.03 GENERAL SUPPORTS

- A. Mechanical Contractor shall provide all necessary channel, angle, brackets, vibration isolators, or supplementary steel as required for adequate support for all piping, specialties, ductwork, and equipment which is hung from the ceiling or roof, or mounted to the floor or roof. For equipment requiring welding or bolting to steel framing, or anchoring to concrete structures, the Mechanical Contractor shall require written approval from the Architect and General Contractor.
- B. Where piping or equipment is suspended from concrete construction, coordinate with the General Contractor to set approved concrete inserts, that shall receive hanger rods such as UniStrut in the concrete form-work. In metal decks, coordinate with General Contractor to use Ramset or welds as required.

3.04 WALL, FLOOR, CEILING, AND ROOF OPENINGS

- A. Locate all openings and advise the General Contractor of details and templates of all openings necessary for inspection of Mechanical work.
- B. All openings including sawcuts, cores, and required lintels shall be provided by the General Contractor, and shall be approved by the Architect and Structural Engineer. Size and location are the responsibility of the Mechanical Contractor. Cracks and rough edges left following installation of equipment shall be caulked, fire-caulked if required, or filled by the Mechanical Contractor.

- C. Perform or pay for all cutting, fitting, repairing, patching and finishing of work of other sections where it is necessary to disturb such work to permit installation of mechanical work.
- D. All roof openings including sawcuts and cores through the roof deck shall be provided by the General Contractor, and shall be approved by the Architect and Structural Engineer. Size and location of the openings are the responsibility of the Mechanical Contractor.
- E. All roof curbs, Pate Curbs, or other specialty curbs shall be the responsibility of the Mechanical Contractor. Specialty roof curb flashings or curb-membranes shall be included.
- F. All roofing materials including standard flashing, and the installation of roofing systems around the Mechanical equipment shall be the responsibility of the General Contractor.
- G. All roof deck supporting materials including angles, joists, etc., shall be the responsibility of the General Contractor, and shall be approved by the Architect and Structural Engineer.

3.05 FIELD CHANGES

- A. The Mechanical Contractor shall not make any field changes that affect the system design, equipment manufacturer, timing, costs, or performance without written approval from the Mechanical and Plumbing Engineer. Approval shall be in the form of a written Field Change Request or Change Order, or Supplemental Instruction. All Change Orders shall be directed through the General Contractor and Architect.
- B. The Contractor assumes liability for any additional costs for changes requested. Should any unauthorized change be determined by the Engineer and Architect as lessening the value of the project, a credit will be request, and shall be issued as a change to the contract.

3.06 PROJECT CLOSE-OUT

- A. Final Acceptance and payment will only be made after final Punch-List completion and receipt at the Engineer's Office of:
 - 1. Approved Operating and Maintenance Instruction Manuals
 - 2. Approved Record Drawings (As Built)
 - 3. All Guarantees/Warranties
 - 4. Certificates of Inspection
 - 5. Written and signed verification that Owner's Training has taken place
 - 6. Final Test and Balance Report (reference SECTION 23 05 93 for Report requirements)
 - 7. All extra materials specified to be provided within the Contract Documents

3.07 CERTIFICATES OF INSPECTION

- A. Submit to the Engineer's Office evidence that installation has been inspected and approved by local or state mechanical inspector and/or the authority having jurisdiction.

3.08 GUARANTEES AND WARRANTIES

- A. All labor, materials and equipment shall be guaranteed by Contractor and/or warranted by Manufacturer for ONE (1) year after acceptance date except where specified longer for special equipment. Contractor shall secure such warranty from all Suppliers (not one year from shipment date) or Contractor to assume warranty.
- B. Acceptance date of substantial completion shall be Owner occupancy as determined by Architect/Engineer.
- C. Contractor shall make all necessary alterations, repairs, adjustments, replacements during guarantee periods as directed by Architect/Engineer to comply with Drawings and Specifications at no cost to Owner.
- D. Repair or replacements made under guarantee bear further ONE (1) year guarantee from date of acceptance of repair or replacement.

- E. At the end of a one year period of continuous operation, make a complete inspection of all systems, fixtures, equipment, safety devices and controls to insure equipment is operating properly, and report to Engineer in writing.

3.09 PLACING EQUIPMENT INTO OPERATION

- A. Mechanical Contractor shall be responsible for all startup procedures, system checks and balancing associated with his equipment.
- B. All equipment shall be installed, tested and operated in accordance with manufacturer's recommendations at normal operating conditions.
- C. All permanent mechanical equipment operated during construction periods shall be cleaned and damaged equipment replaced.

3.10 OWNER'S TRAINING

- A. The option of video taping any and all training sessions shall be given to the Owner at no additional cost, with the Contractor conducting the video taping and with TWO (2) copies of all tapes being turned over to the Owner for future use.
- B. The Mechanical Contractor shall conduct TWO (2) - 4-hour training session(s) on the operation and maintenance of all mechanical equipment. Schedule training with Owner at least 72 hours prior to session(s).
- C. Reference the Specification 230923 for required Temperature Controls Owner's training requirements.

END OF SECTION

**SECTION 23 00 10
MECHANICAL EQUIPMENT AND MATERIALS**

PART 1 GENERAL

1.01 INSTRUCTION:

- A. The Mechanical Contractor is to either copy or remove this specification section from the spec book and complete as follows:
 - 1. Indicate the specific manufacturer on which the bidder's base bid price is based in the blank space provided.
 - 2. Insert the name(s) of each subcontractor used in your bid in the space provided in Part 3.
 - 3. This form shall be submitted with the bid.

1.02 RELATED DOCUMENTS:

- A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this section.

1.03 DEVIATIONS FROM SPECIFIED MATERIAL:

- A. See SECTION 23 00 00, Part 2, Paragraph 2.02 - Substitutions and Changes. Base bid shall be based on manufacturers listed in this specification or on the drawings.

PART 2 PRODUCTS

2.01 THE FOLLOWING IS A LIST OF APPROVED MANUFACTURERS, GROUPED ACCORDING TO TYPES OF MATERIALS OR EQUIPMENT.

- A. Exhaust/Supply Fan(s):
 - 1. Greenheck, Cook, and Acme
- B. Oil Separators:
 - 1. KSI

PART 3 SUB-CONTRACTORS

3.01 INSERT THE NAME OF EACH SUB-CONTRACTOR AND WORK TO BE PERFORMED BELOW:

- A. Subcontractor _____
Work Performed _____
- B. Subcontractor _____
Work Performed _____
- C. Subcontractor _____
Work Performed _____

END OF SECTION

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**SECTION 23 05 10
PENETRATION FIRESTOPPING FOR HVAC**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Section, apply to work specified in this section.

1.02 DEFINITIONS

- A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

- A. Only tested firestop systems shall be used in specific locations as follows:
- B. Penetrations for the passage of duct, piping, and other mechanical equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
- C. Repetitive plumbing penetrations in fire-rated floor assemblies. Penetrations exist for the installation of tubs, showers, aerators and other plumbing fixtures.

1.04 REFERENCES

- A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"
- B. Test Requirements: UL 1479, "Fire Tests of Through-Penetration Firestops"
- C. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
 - 1. UL Fire Resistance Directory:
 - a. Firestop Devices (XHJI)
 - b. Fire Resistance Ratings (BXRH)
 - c. Through-Penetration Firestop Systems (XHEZ)
 - d. Fill, Voids, or Cavity Material (XHHW)
 - e. Forming Materials (XHKU)
- D. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments
- E. Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops."
- F. ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials."
 - 1. International Building Code (IBC 2009)
 - 2. NFPA 101 - Life Safety Code

1.05 QUALITY ASSURANCE

- A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.
- B. Firestop System installation must meet requirements of ASTM E 814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

- D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
- E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.
- B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.
- D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
 - 1. Do not use damaged or expired materials.

1.07 PROJECT CONDITIONS

- A. Do not use materials that contain flammable solvents.
- B. Scheduling
 - 1. Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
 - 2. Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.
- C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.
- E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 - PRODUCTS

2.01 FIRESTOPPING - GENERAL

- A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- C. Penetrations in Fire Resistance Rated Walls: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
 - 1. F-Rating: Not less than the fire-resistance rating of the wall construction being penetrated.

- D. Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
 - 1. F-Rating: Minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
 - 2. T-Rating: when penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
- E. Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
 - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.
- F. Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G21.

2.02 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:
 - 1. Hilti, Inc., Tulsa, Oklahoma
 - a. 800-879-8000
 - b. www.us.hilti.com
 - c. Provide products from the above acceptable manufacturer; no substitutions will be accepted.

2.03 MATERIALS

- A. Use only firestop products that have been UL 1479 or ASTM E 814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- B. Pre-installed firestop devices for use with noncombustible and combustible pipes (closed and open systems) penetrating concrete floors and/or gypsum walls, the following products are acceptable:
 - 1. Hilti Cast-In Place Firestop Device (CP 680-P) for use with combustible penetrants.
 - 2. Hilti Cast-In Place Firestop Device (CP 680-M) for use with noncombustible penetrants.
 - 3. Hilti Speed Sleeve (CP 653) for use with cable penetrations.
 - 4. Hilti Firestop Drop-In Device (CFS-DID) for use with noncombustible and combustible penetrants.
 - 5. Hilti Firestop Block (CFS-BL)
- C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
 - 1. Hilti Intumescent Firestop Sealant (FS-ONE)
 - 2. Hilti Self-leveling Firestop Sealant (CP 604)
 - 3. Hilti Fire Foam (CP 620)
 - 4. Hilti Flexible Firestop Sealant (CP 606)
 - 5. Hilti Elastomeric Firestop Sealant (CP 601S)
- D. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
 - 1. Hilti Elastomeric Firestop Sealant (CP 601S)
 - 2. Hilti Flexible Firestop Sealant (CP 606)
 - 3. Hilti Intumescent Firestop Sealant (FS-ONE)

- E. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
 - 1. Hilti Intumescent Firestop Sealant (FS-ONE)
- F. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
 - 1. Hilti Intumescent Firestop Sealant (FS-ONE)
 - 2. Hilti Fire Foam (CP 620)
 - 3. Hilti Elastomeric Firestop Sealant (CP 601S)
 - 4. Hilti Flexible Firestop Sealant (CP 606)
- G. Non-curing, re-penetrable, intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:
 - 1. Hilti Firestop Putty Stick (CP 618)
 - 2. Hilti Firestop Plug (CFS-PL)
- H. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:
- I. Hilti Firestop Collar (CP 643N)
 - 1. Hilti Firestop Collar (CP 644)
 - 2. Hilti Wrap Strips (CP 648E/648S)
- J. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
 - 1. Hilti Firestop Mortar (CP 637)
 - 2. Hilti Firestop Block (CFS-BL)
 - 3. Hilti Fire Foam (CP 620)
 - 4. Hilti Firestop Board (CP 675T)
- K. Non curing, re-penetrable materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
 - 1. Hilti Firestop Block (CFS-BL)
 - 2. Hilti Firestop Board (CP 675T)
- L. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:
 - 1. Hilti Firestop Block (CFS-BL)
 - 2. Hilti Firestop Plug (CFS-PL)
- M. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E 814 which is equal to the time rating of construction being penetrated.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
 - 1. Verify penetrations are properly sized and in suitable condition for application of materials.
 - 2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
 - 3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
 - 4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

- A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.
- B. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

3.03 INSTALLATION

- A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.
- B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration joint materials.
 1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
 2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
 3. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROL

- A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
- D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.05 ADJUSTING AND CLEANING

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION

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SECTION 23 05 53
MECHANICAL IDENTIFICATION FOR PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Pipe markers.

1.02 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2007.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2013.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Piping: Pipe markers.
- B. Small-sized Equipment: Tags.
- C. Thermostats: Nameplates.

2.02 NAMEPLATES

- A. Manufacturers:
 - 1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.
 - 2. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 - 4. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.
 - 5. Letter Color: White.
 - 6. Letter Height: 1/4 inch (6 mm).
 - 7. Background Color: Black.
 - 8. Plastic: Comply with ASTM D709.

2.03 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.

2.04 PIPE MARKERS

- A. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- C. Color code as follows:
 - 1. Heating, Cooling, and Boiler Feedwater: Green with white letters.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

- B. Install tags with corrosion resistant chain.
- C. Apply stencil painting in accordance with Section 09 91 23.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- F. Install underground plastic pipe markers 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe.
- G. Use tags on piping 3/4 inch (20 mm) diameter and smaller.
 - 1. Identify service, flow direction, and pressure.
 - 2. Install in clear view and align with axis of piping.
 - 3. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- H. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- I. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of hydronic systems.
- B. Measurement of final operating condition of HVAC systems.

1.02 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.
- B. AABC MN-1 - AABC National Standards for Total System Balance; 2002.
- C. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems 2008, with Errata (2019).
- D. NEBB (TAB) - Procedural Standard for Testing Adjusting and Balancing of Environmental Systems 2019.
- E. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing 2002.

1.03 SUBMITTALS

- A. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 - 1. Revise TAB plan to reflect actual procedures and submit as part of final report.
 - 2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Engineer and for inclusion in operating and maintenance manuals.
 - 3. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
 - 4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 - 5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 - 6. Units of Measure: Report data in I-P (inch-pound) units only.
 - 7. Include the following on the title page of each report:
 - a. Name of Testing, Adjusting, and Balancing Agency.
 - b. Address of Testing, Adjusting, and Balancing Agency.
 - c. Telephone number of Testing, Adjusting, and Balancing Agency.
 - d. Project name.
 - e. Project location.
 - f. Project Engineer.
 - g. Report date.

PART 2 EXECUTION

2.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
 - 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
 - 3. SMACNA (TAB).
 - 4. National Balancing Council (NBC).
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

- C. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 - 2. Having minimum of three years documented experience.
 - 3. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
 - b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
 - c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.
 - d. NBC, The National Balancing Council.
- D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

2.02 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Fire and volume dampers are in place and open.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Duct system leakage is minimized.
 - 12. Hydronic systems are flushed, filled, and vented.
 - 13. Pumps are rotating correctly.
 - 14. Proper strainer baskets are clean and in place.
 - 15. Service and balance valves are open.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.

2.03 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 10 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

2.04 RECORDING AND ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

2.05 WATER SYSTEM PROCEDURE

- A. Adjust water systems to provide required or design quantities.
- B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- D. Effect system balance with automatic control valves fully open to heat transfer elements.
- E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

2.06 SCOPE

- A. Test, adjust, and balance the following:
 - 1. Plumbing Pumps.
 - 2. HVAC Pumps.
 - 3. Boilers.
 - 4. Exhaust Fans.

2.07 MINIMUM DATA TO BE REPORTED

- A. Electric Motors:
 - 1. Manufacturer.
 - 2. Model/Frame.
 - 3. HP/BHP.
 - 4. Phase, voltage, amperage; nameplate, actual, no load.
 - 5. RPM.
 - 6. Service factor.
 - 7. Starter size, rating, heater elements.
- C. Exhaust Fans:
 - 1. Location.
 - 2. Manufacturer.
 - 3. Model number.
 - 4. Serial number.
 - 5. Air flow, specified and actual.
 - 6. Total static pressure (total external), specified and actual.
 - 7. Inlet pressure.

END OF SECTION

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SECTION 23 07 19 PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019, with Editorial Revision (2023).
- D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2022a.
- E. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- G. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.03 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

2.02 GLASS FIBER, RIGID

- A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
 - 1. K (Ksi) Value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
 - 2. Maximum Service Temperature: 850 degrees F (454 degrees C).
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- B. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches (0.029 ng/Pa s m).

2.03 JACKETS

- A. PVC Plastic.
 - 1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F (minus 18 degrees C).
 - b. Maximum Service Temperature: 150 degrees F (66 degrees C).

- c. Moisture Vapor Permeability: 0.002 perm inch (0.0029 ng/Pa s m), maximum, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil (0.25 mm).
 - e. Connections: Brush on welding adhesive.
- B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
 - 1. Thickness: 0.016 inch (0.40 mm) sheet.
 - 2. Finish: Smooth.
 - 3. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
 - 4. EFittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated Pipes Conveying Fluids Below Ambient Temperature:
 - 1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. For hot piping conveying fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- G. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- H. Inserts and Shields:
 - 1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.
 - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - 3. Insert location: Between support shield and piping and under the finish jacket.
- I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.
- J. Buried Piping: Provide factory-fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil (0.025 mm) thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.

3.03 SCHEDULE

A. Heating Systems:

1. Heating Water Supply and Return: Piping 1-1/2" and smaller - 1/2" thickness; Pipe larger than 1-1/2" - 1" thickness.

B. Other Systems:

1. Heat Pump Water Supply and Return: All piping: 1" thickness.

END OF SECTION

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**SECTION 23 11 23
FACILITY NATURAL-GAS PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe, pipe fittings, valves, and connections for natural gas piping systems.

1.02 REFERENCE STANDARDS

- A. ANSI Z21.18/CSA 6.3 - Gas Appliance Pressure Regulators 2019.
- B. ANSI Z21.80/CSA 6.22 - Line Pressure Regulators 2019.
- C. ANSI Z223.1 - National Fuel Gas Code 2021.
- D. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2023.
- E. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.
- F. ASME B31.1 - Power Piping 2022.
- G. ASME B31.9 - Building Services Piping 2020.
- H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- I. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2023.
- J. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2018.
- K. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .

1.03 SUBMITTALS

1.04 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.
- D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.
- E. Identify pipe with marking including size, ASTM material classification, and ASTM specification.

PART 2 PRODUCTS

2.01 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 Inches (80 mm) and Under:
 - 1. Ferrous Pipe: Class 150 malleable iron threaded unions.
- B. Flanges for Pipe Size Over 1 Inch (25 mm):
 - 1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.

2.02 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 - 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 - 3. Trapeze Hangers: Welded steel channel frames attached to structure.

4. Vertical Pipe Support: Steel riser clamp.
5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install tracer wire with all buried gas piping, per IFGC requirements. Burial depth shall comply with all Code requirements.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Provide access where valves and fittings are not exposed.
- G. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- H. Provide support for utility meters in accordance with requirements of utility companies.
- I. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
 1. Painting of exterior piping systems and components is specified in Section 09 91 13.
- J. Install valves with stems upright or horizontal, not inverted.
- K. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.
- L. Sleeve pipes passing through partitions, walls and floors.
- M. Inserts:
 1. Provide inserts for placement in concrete formwork.
 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- N. Pipe Hangers and Supports:
 1. Install in accordance with ASME B31.9.
 2. Place hangers within 12 inches (300 mm) of each horizontal elbow.
 3. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

3.03 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- C. Provide plug valves in natural gas systems for shut-off service.

3.04 SERVICE CONNECTIONS

- A. Provide new gas service complete with gas meter and regulators in accordance with Section 33 52 16. Gas service distribution piping to have initial minimum pressure of 14 inch wg (XX kPa). Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

3.05 SCHEDULES

- A. Pipe Hanger Spacing:
 - 1. Metal Piping:
 - a. Pipe Size: 1/2 inches (15 mm) to 1-1/4 inches (32 mm):
 - 1) Maximum Hanger Spacing: 6.5 ft (2 m).
 - 2) Hanger Rod Diameter: 3/8 inches (9 mm).
 - b. Pipe Size: 1-1/2 inches (40 mm) to 2 inches (50 mm):
 - 1) Maximum Hanger Spacing: 10 ft (3 m).
 - 2) Hanger Rod Diameter: 3/8 inch (9 mm).
 - c. Pipe Size: 2-1/2 inches (65 mm) to 3 inches (75 mm):
 - 1) Maximum Hanger Spacing: 10 ft (3 m).
 - 2) Hanger Rod Diameter: 1/2 inch (13 mm).
 - d. Pipe Size: 4 inches (100 mm) to 6 inches (150 mm):
 - 1) Maximum Hanger Spacing: 10 ft (3 m).
 - 2) Hanger Rod Diameter: 5/8 inch (15 mm).

END OF SECTION

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**SECTION 23 55 33
FUEL-FIRED UNIT HEATERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Gas fired unit heaters.
- B. Room thermostats.

1.02 REFERENCE STANDARDS

- A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. ASHRAE Std 103 - Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers 2022.
- C. NFPA 54 - National Fuel Gas Code 2021.
- D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
- E. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances 2019.

1.03 SUBMITTALS

- A. Product Data: Provide manufacturer's literature and data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- B. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.

PART 2 PRODUCTS

2.01 UNIT HEATER MANUFACTURERS

- A. Modine Manufacturing Company:
- B. Trane Corporation :
- C. Reznor :

2.02 GAS FIRED UNIT HEATERS

- A. Unit Heaters: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner, controls, and accessories:
 - 1. Heating: Natural gas fired.
 - 2. Discharge Louvers: Individually adjustable horizontal and vertical louvers to match cabinet finish.
- B. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.
- C. Supply Fan: Propeller type with direct drive.
- D. Heat Exchanger: Aluminized steel welded construction.
- E. Gas Burner:
 - 1. Electronic pilot ignition, with electric spark igniter.
- F. Gas Burner Safety Controls:
 - 1. Thermocouple Sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
 - 2. Vent Safety Shutoff Sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.
- G. Operating Controls:
 - 1. Room Thermostat: Cycles burner to maintain room temperature setting.

H. Performance:

1. Ratings: Energy Efficiency Rating (EER)/Coefficient of Performance (COP) not less than requirements of ASHRAE Std 90.1 I-P; seasonal efficiency to ASHRAE Std 103.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with NFPA 90A.
- B. Install gas fired units in accordance with NFPA 54 and applicable codes.
- C. Provide vent connections in accordance with NFPA 211.

END OF SECTION

SECTION 26 0519
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 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.
 - 2. Section 271500 "Communications Horizontal Cabling" for cabling used for voice and data circuits.

PART 2 - PRODUCTS

2.1 CABLE TYPES NOT ALLOWED

- A. The following cables **are not allowed** on this project: armored cable Type AC, metal-clad cable Type Mc, mineral Insulated Type MI, and nonmetallic-sheathed cable Type NM

2.2 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. RoHS compliant.
 - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- D. Conductor Insulation:
 - 1. Type THHN and Type THWN-2: Comply with UL 83.
 - 2. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
 - 3. Type XHHW-2: Comply with UL 44.

2.3 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. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. RoHS compliant.
 - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Conductors: Aluminum, complying with ASTM B 800 and ASTM B 801.
- D. Conductor Insulation:
 - 1. Type THHN and Type THWN-2: Comply with UL 83
 - 2. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
 - 3. Type XHHW-2: Comply with UL 44.

- E. Circuits:
 - 1. Single circuit and multi-circuit with color-coded conductors.
 - 2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.
- F. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors Aluminum, complying with ASTM B 800 and ASTM B 801.
- G. Ground Conductor: Insulated.
- H. Conductor Insulation:
 - 1. Type TFN/THHN/THWN-2: Comply with UL 83.
 - 2. Type XHHW-2: Comply with UL 44.
- I. Armor: Steel interlocked.
- J. Jacket: PVC applied over armor.

2.4 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. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
 - 1. Material: Bronze.
 - 2. Type: Two hole with standard barrels.
 - 3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- D. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- E. 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. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- C. Coordinate "Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground" Paragraph below with Section 260543 "Underground Ducts and Raceways for Electrical Systems."
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-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 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "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 un-spliced 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 inches of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "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 078400-Firestopping.

END OF SECTION

SECTION 26 0526
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. Foundation steel electrodes.

1.2 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
 - 1. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - a. Ground rods.
 - b. Grounding arrangements and connections for separately derived systems.

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 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 B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.3 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. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.
- E. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- F. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- G. Conduit Hubs: Mechanical type, terminal with threaded hub.
- H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- I. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- J. Straps: Solid copper, copper lugs. Rated for 600 A.
- K. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- L. 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.

2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches below grade.
- C. 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 Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.

3.4 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.

3.5 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 Rods: Drive rods until tops are 2 inches 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.
- C. 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.
- D. 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.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections
- B. Retain "Tests and Inspections" Paragraph below to describe tests and inspections to be performed.
- C. 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. 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.
- D. Grounding system will be considered defective if it does not pass tests and inspections.

- E. Prepare test and inspection reports.
- F. 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.
- G. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 0529
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. Structural steel for fabricated supports and restraints.
 - 4. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
 - 5. Fabricated metal equipment support assemblies.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch diameter holes at a maximum of 8 inches o.c. in at least one surface.
 - 1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 2. Material for Channel, Fittings, and Accessories: Galvanized steel.
 - 3. Channel Width: Selected for applicable load criteria.
 - 4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 5. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
- B. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- D. 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.
 - 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.
 - 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 A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 - 1. NECA1.
 - 2. NECA101

- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- D. 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.
- E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.1 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC and RMC may be supported by openings through structure members, according to NFPA 70.
- C. 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 New Concrete: Bolt to concrete inserts.
 - 2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 3. To Existing Concrete: Expansion anchor fasteners.
 - 4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 - 5. To Steel: Beam clamps (MSSSP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69 Spring-tension clamps.
 - 6. To Light Steel: Sheet metal screws.
 - 7. 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.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.2 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "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.

END OF SECTION

SECTION 26 0553
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. Bands and tubes.
 - 4. Tapes and stencils.
 - 5. Tags.
 - 6. Signs.
 - 7. Cable ties.
 - 8. Paint for identification.
 - 9. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 Raceways and Cables Carrying Circuits at 600 V or Less:

- 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase-and Voltage-Level Identification, 600V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
 - 1. Color shall be factory applied.
 - 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: Bare copper or Green.
 - 5. Colors for Isolated Grounds: Green with white stripe.
- 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. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
- E. Equipment Identification Labels:
 - 1. Black letters on a white field.

2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
- B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameter and that stay in place by gripping action.
- C. Self-Adhesive Wraparound Labels: Write-on 3-mil- thick, polyester flexible label with acrylic pressure-sensitive adhesive.
 - 1. 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.
 - 2. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 3. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil- thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
 - 1. Minimum Nominal Size:
 - a. 1-1/2 by 6 inches for raceway and conductors.
 - b. 3-1/2 by 5 inches for equipment.
 - c. As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

- A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameter and that stay in place by gripping action.
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around item being identified. Full shrink recovery occurs at a maximum of 200 deg F Comply with UL 224.

2.5 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.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
- C. Tape and Stencil: 4-inch- wide black stripes on 10-inch centers placed diagonally over orange background and is 12 inches wide. Stop stripes at legends.
- D. Floor Marking Tape: 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
- E. Underground-Line Warning Tape:
 - 1. 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.
 - 2. Color and Printing:
 - a. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE"
 - b. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE"
- F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.6 TAGS

- A. Write-on Tags:
 - 1. Polyester Tags: 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment.
 - 2. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 3. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.7 SIGNS

- A. Baked-Enamel Signs:
 - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal Size: 7 by 10 inches.
- B. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Engraved legend.
 - 2. Thickness:
 - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
 - b. For signs larger than 20 sq. in, 1/8 inch thick.
 - c. Engraved legend with black letters on white face.
 - d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.8 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch
 - 2. Color: Black, except where used for color-coding.
- 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
 - 2. Color: Black.
- C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
 - 1. Minimum Width: 3/16 inch.
 - 2. UL 94 Flame Rating: 94V-0.
 - 3. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections 09 9113 & 09 9123 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 600V: 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. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- J. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- K. Vinyl Wraparound Labels:
 - 1. Secure tight to surface at a location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- L. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- M. Self-Adhesive Wraparound Labels: Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
- N. Self-Adhesive Labels:
 - 1. On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
- O. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- P. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- Q. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- R. 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 where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- S. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- T. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- U. 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 below finished grade. Use multiple tapes where width of multiple lines installed in a common trench.
 - 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.

V. Write-on Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using general-purpose cable ties.

W. Baked-Enamel Signs:

1. Attach signs 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- high letters on minimum 1-1/2-inch- high sign; where two lines of text are required, use signs minimum 2 inches high.

X. 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- high letters on minimum 1-1/2-inch- high sign; where two lines of text are required, use signs minimum 2 inches high.

Y. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

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, 600V or Less, for Service, Feeder, and Branch Circuits, More Than 30A and 120V to Ground: Identify with self-adhesive raceway labels.
 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- D. Power-Circuit Conductor Identification, 600V or Less: For conductors in vaults, pull and junction boxes, use vinyl wraparound labels to identify the phase.
 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use write-on tags with the conductor or cable designation, origin, and destination.
- F. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- G. 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.
- H. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- I. Arc Flash Warning Labeling: Self-adhesive labels.

END OF SECTION

SECTION 26 0923
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Standalone daylight-harvesting switching and dimming controls.
 - 2. Indoor occupancy and vacancy sensors.
 - 3. Switchbox-mounted occupancy and vacancy sensors
 - 4. Digital timer light switches.
 - 5. High-bay occupancy and vacancy sensors.
- B. Related Requirements:
 - 1. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Interconnection diagrams showing field-installed wiring.
 - 2. Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
- B. Software and firmware operational documentation.

1.4 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY AND VACANCY SENSORS

- A. General Requirements for Sensors:
 - 1. Wall and Ceiling-mounted, solid-state indoor occupancy and vacancy sensors.
 - 2. Dual technology.
 - 3. Integrated and Separate power pack.
 - 4. Hardwired and Wireless connection to switch and lighting control system.
 - 5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 6. Operation:
 - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - c. Combination Sensor: Unless otherwise indicated, sensor shall be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - 7. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A or Wireless.
 - 8. Power: Line voltage.

9. Power Pack: Dry contacts rated for 20-A LED load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
10. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
12. Bypass Switch: Override the "on" function in case of sensor failure.
13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc turn lights off when selected lighting level is present.
- B. Dual-Technology Type: Wall and Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
 1. Sensitivity Adjustment: Separate for each sensing technology.
 2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
 4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet when mounted 48 inches above finished floor.

2.2 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox using hardwired connection or using wireless connection.
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
 4. Switch Rating: Not less than 800-VA LED load at 120 V, 1200-VA load at 277 V, and 800-W incandescent.
- B. Wall-Switch Sensor
 1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft.
 2. Sensing Technology: Dual technology.
 3. Switch Type: SP, field-selectable automatic "on," or manual "on," automatic "off."
 4. Capable of controlling load in three-way application.
 5. Voltage: Match the circuit voltage.
 6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
 7. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
 8. Concealed, "off" time-delay selector at 30 seconds and 5, 10, and 20 minutes.
 9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

10. Color: White.
11. Faceplate: Color matched to switch.
12. Color: White.
13. Faceplate: Color matched to switch.

2.3 OUTDOOR MOTION SENSORS

- A. Description: Solid-state outdoor motion sensors.
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. PIR type, weatherproof. Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. Comply with UL 773A.
 3. Switch Rating:
 - a. Luminaire-Mounted Sensor: 500-VA LED.
 - b. Separately Mounted Sensor: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 4. Voltage: Match the circuit voltage type.
 5. Detector Coverage:
 - a. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft.
 - b. Long Range: 180-degree field of view and 110-foot detection range.
 6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
 7. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
 8. Concealed, "off" time-delay selector at 30 seconds and 5, 10, and 20 minutes.
 9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and help eliminate false "off" switching.
 10. Operating Ambient Conditions: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F, rated as "raintight" according to UL 773A.

2.4 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- C. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- D. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

- E. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.
- B. Wiring within Enclosures: Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."
- B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Lighting control devices will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 - 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
 - 3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.6 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 - 1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

END OF SECTION

SECTION 26 2416

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Distribution panelboards.
 - 2. 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.
 - 9. Key interlock scheme drawing and sequence of operations.
 - 10. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.4 INFORMATIONAL SUBMITTALS

- A. Panelboard schedules for installation in panelboards.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 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.

1.7 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.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "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: Surface-mounted, dead-front cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Height: 84 inches 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: 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: Compression type, with a lug on the neutral bar for each pole in the panelboard.
 - 3. Ground Lugs and Bus-Configured Terminators: Compression 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: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.
- L. 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. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.3 POWER PANELBOARDS

- A. Panelboards: NEMA PB 1, distribution type.
- B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 - 1. For doors more than 36 inches high, provide two latches, keyed alike.
- C. Mains: Circuit breaker.
- D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices: Fused switches.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. 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. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Electronic Trip Circuit Breakers:
 - a. RMS sensing.
 - b. Field-replaceable rating plug or electronic trip.
 - c. Digital display of settings, trip targets, and indicated metering displays.
 - d. Multi-button keypad to access programmable functions and monitored data.
 - e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
 - f. Integral test jack for connection to portable test set or laptop computer.
 - g. Field-Adjustable Settings:
 - 1) Instantaneous trip.
 - 2) Long- and short-time pickup levels.
 - 3) Long and short time adjustments.
 - 4) Ground-fault pickup level, time delay, and I squared T response.
4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. 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: Compression 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. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
 - h. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.
 - i. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
- B. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
 1. Fuses and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."

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.

2.6 ACCESSORY COMPONENTS AND FEATURES

- A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

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 90 inches above finished floor unless otherwise indicated.
- 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.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- 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. 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 260553 "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 260553 "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 260553 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 260553 "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 Acceptance Testing Specification. 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

SECTION 26 2726
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Standard-grade receptacles, 125 V, 20 A.
 - 2. GFCI receptacles, 125 V, 20 A.
 - 3. Toggle switches, 120/277 V, 20 A.
 - 4. Occupancy sensors.
 - 5. Wall-box dimmers.
 - 6. Wall plates.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Comply with NFPA 70.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: White unless otherwise indicated or required by NFPA 70 or device listing.
- F. Wall Plate Color: For plastic covers, match device color.
- G. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

- A. Duplex Receptacles, 125 V, 20 A.
 - 1. Description: Two pole, three wire, and self-grounding.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Standards: Comply with UL 498 and FS W-C-596.
- B. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:
 - 1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Standards: Comply with UL 498 and FS W-C-596.
 - 4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.
- C. Weather-Resistant Duplex Receptacle, 125 V, 20 A:
 - 1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.

2. Configuration: NEMA WD 6, Configuration 5-20R.
 3. Standards: Comply with UL 498.
 4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.
- D. Weather-Resistant Duplex Receptacle, 125 V, 15 A:
1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
 2. Configuration: NEMA WD 6, Configuration 5-15R.
 3. Standards: Comply with UL 498.
 4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

2.3 GFCI RECEPTACLES, 125 V, 20 A

- A. Duplex GFCI Receptacles, 125 V, 20 A:
1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
 2. Configuration: NEMA WD 6, Configuration 5-20R.
 3. Type: Non-feed through.
 4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

2.4 TOGGLE SWITCHES, 120/277 V, 20 A

- A. Single-Pole Switches, 120/277 V, 20 A:
1. Standards: Comply with UL 20 and FS W-S-896.
- B. Two-Pole Switches, 120/277 V, 20 A:
1. Comply with UL 20 and FS W-S-896.
- C. Three-Way Switches, 120/277 V, 20 A:
1. Comply with UL 20 and FS W-S-896.

2.5 OCCUPANCY SENSORS

- A. Wall Switch Sensor Light Switch, Dual Technology:
1. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual (ultrasonic and passive infrared) technology.
 2. Standards: Comply with UL 20.
 3. Rated 10 A at 120 V ac LED lighting, and 1/4 hp at 120 V ac.
 4. Adjustable time delay of five minutes.
 5. Able to be locked to Manual-On mode.
 6. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc.
- B. Telephone Outlet:
1. Description: Single RJ-11 jack for terminating Category 3, balanced twisted pair cable complying with Section 260523 "Control-Voltage Electrical Power Cables."
 2. Standards: Comply with UL 1863.

2.6 DIMMERS

- A. Wall-Box Dimmers:
1. Description: Modular, full-wave, solid-state dimmer switch with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
 2. Control: Continuously adjustable slider with single-pole or three-way switching.
 3. Standards: Comply with UL 1472.
 4. LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.7 WALL PLATES

- A. Single Source: Obtain wall plates from same manufacturer of wiring devices.
- B. Single and combination types shall match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Finished Spaces: Smooth, high-impact thermoplastic 0.035-inch- thick.
 3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant die-cast aluminum with lockable cover.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 1. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 2. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 3. Install wiring devices after all wall preparation, including painting, is complete.
- C. Device Installation:
 1. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 2. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- D. Receptacle Orientation:
 1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
 2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.
- E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- F. Dimmers:
 1. Install dimmers within terms of their listing.
 2. Verify that dimmers used for fan-speed control are listed for that application.
 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device, listing conditions in the written instructions.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.
- H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Test Instruments: Use instruments that comply with UL 1436.
 2. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Receptacles:
 1. Line Voltage: Acceptable range is 105 to 132 V.
 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.

- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION

SECTION 26 5119
LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following types of LED luminaires:
 - 1. Linear industrial.
 - 2. Low bay.
 - 3. Recessed, linear.
 - 4. Strip light.
 - 5. Suspended, linear.
 - 6. Suspended, nonlinear.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
 - 2. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
- B. Shop Drawings: For nonstandard or custom luminaires.
 - 1. Include plans, elevations, sections, and mounting and attachment details.
 - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Samples: For each luminaire and for each color and texture with standard factory-applied finish.

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. Product Certificates: For each type of luminaire.
- C. Product test reports.
- D. 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. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- C. Provide luminaires from a single manufacturer for each luminaire type.
- D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

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 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.

2.2 LOWBAY.

- A. Nominal Operating Voltage: 120 V ac.
- B. Lamp:
 - 1. Minimum 18,000 lumen.
 - 2. Minimum allowable efficacy of 130 lumens/W.
 - 3. CRI of minimum of 80. CCT of 4100 K.
 - 4. Rated lamp life of 50,000 hours to L70.
 - 5. Dimmable from 100 percent to 10 percent of maximum light output.
 - 6. Internal driver.
 - 7. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.
- C. Housings:
 - 1. Reinforced Fiberglass housing.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.
- E. Diffusers and Globes:
 - 1. High Impact Prismatic acrylic.
 - 2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 3. Glass: Annealed crystal glass unless otherwise indicated.
 - 4. Lens Thickness: At least 0.125- minimum unless otherwise indicated.
- F. Standards:
 - 1. ENERGY STAR certified.
 - 2. RoHS compliant.
 - 3. UL Listing: Listed for high pressure washdown location.

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 A 36 for carbon structural steel.

- 2. ASTM A 568 for sheet steel.
- C. Stainless Steel:
 - 1. 1. Manufacturer's standard grade.
 - 2. 2. Manufacturer's standard type, ASTM A 240.
- D. Galvanized Steel: ASTM A 653.
- E. Aluminum: ASTM B 209.

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 260529 "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 steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641, Class 3, soft temper, zinc-coated steel, 12 gage.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 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 re-lamping.
 - 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 260519 "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 260553 "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.

END OF SECTION

SECTION 26 5213

EXIT LIGHTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exit signs.

1.2 DEFINITIONS

- A. Fixture: See "Luminaire" Paragraph.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of exit sign.
- B. Shop Drawings: For nonstandard or custom luminaires.
 - 1. Include plans, elevations, sections, and mounting and attachment details.
 - 2. Include details of equipment 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.

1.5 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: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- 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: Fabricate and label exit signs comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.

2.2 EXIT SIGNS

- A. Internally Lighted Signs:
 - 1. Operating at nominal voltage of 120 V ac.
 - 2. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.

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. Doors, Frames, and Other Internal Access:
 - 1. Smooth operating, free of light leakage under operating conditions.
 - 2. Designed to permit re-lamping without use of tools.
 - 3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.
- C. Diffusers and Globes:
 - 1. Prismatic acrylic.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
 - 3. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

- 4. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- D. Housings:
 - 1. Extruded aluminum housing and heat sink.
 - 2. White powder coat finish.

2.4 METAL FINISHES

- A. 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.

2.5 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

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 and emergency power unit weight.
 - 2. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
 - 3. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and vertical force of 400 percent of fixture weight.
- E. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

END OF SECTION

SECTION 26 5619
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.
 - 3. Luminaire-mounted photoelectric relays.
- B. Related Requirements:
 - 1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
 - 2. Section 265613 "Lighting Poles and Standards" for poles and standards used to support exterior lighting equipment.

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 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of the following:
 - 1. Luminaire.
 - 2. Photoelectric relay.
- B. Sample warranty.

1.5 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.

1.6 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: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 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. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. UL Compliance: Comply with UL 1598 and listed for wet location.
- E. CRI of minimum 70. CCT of 5000K.
- F. L70 lamp life of 50,000 hours.
- G. Lamps dimmable from 100 percent to 10 percent of maximum light output.
- H. Nominal Operating Voltage: 208V.
- I. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.
- J. Source Limitations: Obtain luminaires from single source from a single manufacturer.
- K. Source Limitations: 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.

2.2 LUMINAIRE TYPES

- A. Area and Site:
 - 1. Luminaire Shape: Square.
 - 2. Mounting: Pole and Building with extruded aluminum arm, 11 inches nominal in length.
 - 3. Luminaire-Mounting Height: 30' -6" from finished grade.
 - 4. Distribution: as indicated on fixture schedule.
- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Corrosion-resistant aluminum. Form and support to prevent warping and sagging.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.
- 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.

2.3 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.
 - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
 - 3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 - 4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
 - a. Color: As indicated on drawings or selected by Architect.

2.4 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

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. Install lamps in each luminaire.
- D. Fasten luminaire to structural support.
- E. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and re-lamping.
 - 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.
- F. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls.
- G. Wiring Method: Install cables in raceways. Conceal raceways and cables.
- H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated.
- I. Coordinate layout and installation of luminaires with other construction.
- J. Adjust luminaires that require field adjustment or aiming.
- K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.2 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 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 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.
 - 3. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- 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.

3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires.

END OF SECTION