TECHNICAL SPECIFICATIONS FOR *Clewiston Transfer Station Repair and Rehabilitation* CIP-200624, CN200224JJB

December 2022

KHA Project No. 148220021

PREPARED FOR

Lee County Solid Waste Department

PREPARED BY

Kimley-Horn and Associates, Inc.

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This item has been digitally signed and sealed by Seth E. Schmid, P.E. on the date indicated here. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.
The above named Professional Engineer shall be responsible for the following Divisions in accordance with Rule 61G15-23.004, F.A.C.:
Division 1 General Requirements Division 2 Existing Conditions Division 3 Concrete Division 5 Metals Division 8 Openings Division 9 Finishes Division 13 Special Construction
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The above named Professional Engineer shall be responsible for the following Divisions in accordance with Rule 61G15-23.004, F.A.C.:
Division 23 Heating, Ventilating, and Air Conditioning (HVAC)

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The above named Professional Engineer shall be responsible for the following Divisions in accordance with Rule 61G15-23.004, F.A.C.:
Division 26 Electrical

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DIVISION 1 GENERAL REQUIREMENTS SECTION 01 33 00 SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. Owner Lee County Solid Waste Department, or their appointed representative.
- B. Specifier Specifying engineer or consulting firm.
- C. Contractor Selected contractor who is awarded the project.
- D. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action.
- E. Informational Submittals: Written and graphic information and physical Samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements.

1.2 SUBMITTAL PROCEDURES

- A. Transmit each submittal with a Transmittal Letter.
- B. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.
- C. Identify: Project, Contractor, Subcontractor and supplier, pertinent Drawing and detail number, and Specification Section number appropriate to submittal.
- D. 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 according to requirements of the Work and Contract Documents.
- E. Schedule submittals to expedite Project, and submit as PDF electronic files to Owner and Engineer. Coordinate submission of related items.
- F. For each submittal for review, allow 15 days excluding delivery time to and from Contractor.
- G. Identify variations in Contract Documents and product or system limitations that may be detrimental to successful performance of completed Work.
- H. Allow space on submittals for Contractor and Engineer review stamps and comments.
- I. When revised for resubmission, cloud or highlight changes made since previous submission.
- J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.
- K. Submittals not requested will not be recognized nor processed.
- L. Incomplete Submittals: Engineer will not review. Complete submittals for each item are required. Delays resulting from incomplete submittals are not the responsibility of Engineer.

1.3 PROPOSED PRODUCT LIST

- A. Within 15 days after date of Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product. Provide a table indicating the intent (location and use) of each proposed product.
- B. For products specified only by reference standards, indicate manufacturer, trade name, model or catalog designation, and reference standards.

1.4 **PRODUCT DATA**

- A. Product Data: Action Submittal: Submit to Engineer for review for assessing conformance with information given and design concept expressed in Contract Documents.
- B. Submit electronic submittals via email as PDF electronic files.
- C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

1.5 ELECTRONIC CAD FILES OF PROJECT DRAWINGS

- A. Electronic CAD Files of Project Drawings: May only be used to expedite production of Shop Drawings for the Project. Use for other Projects or purposes is not allowed.
- B. Electronic CAD Files of Project Drawings: Distributed only under the following conditions:
 - Use of files is solely at receiver's risk. Engineer does not warrant accuracy of files. Receiving files in electronic form does not relieve receiver of responsibilities for measurements, dimensions, and quantities set forth in Contract Documents. In the event of ambiguity, discrepancy, or conflict between information on electronic media and that in Contract Documents, notify Engineer of discrepancy and use information in hard-copy Drawings and Specifications.
 - 2. CAD files do not necessarily represent the latest Contract Documents, existing conditions, and as-built conditions. Receiver is responsible for determining and complying with these conditions and for incorporating addenda and modifications.
 - User is responsible for removing information not normally provided on Shop Drawings and removing references to Contract Documents. Shop Drawings submitted with information associated with other trades or with references to Contract Documents will not be reviewed and will be immediately returned.
 - 4. Receiver shall not hold Engineer responsible for data or file clean-up required to make files usable, nor for error or malfunction in translation, interpretation, or use of this electronic information.
 - 5. Receiver shall understand that even though Engineer has computer virus scanning software to detect presence of computer viruses, there is no guarantee that computer viruses are not present in files or in electronic media.

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6. Receiver shall not hold Engineer responsible for such viruses or their consequences, and shall hold Engineer harmless against costs, losses, or damage caused by presence of computer virus in files or media.

1.6 SHOP DRAWINGS

- A. Shop Drawings: Action Submittal: Submit to Engineer for assessing conformance with information given and design concept expressed in Contract Documents.
- B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. When required by individual Specification Sections, provide Shop Drawings signed and sealed by a professional Engineer responsible for designing components shown on Shop Drawings.
 - 1. Include signed and sealed calculations to support design.
 - 2. Submit Shop Drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
 - 3. Make revisions and provide additional information when required by authorities having jurisdiction.
- D. Submit electronic submittals via email as PDF electronic files.

1.7 SAMPLES

- A. Samples: Action Submittal: Submit to Engineer for assessing conformance with information given and design concept expressed in Contract Documents.
- B. Samples for Selection as Specified in Product Sections:
 - 1. Submit to Engineer for aesthetic, color, and finish selection.
 - 2. Submit Samples of finishes, textures, and patterns for Engineer selection.
- C. Submit Samples to illustrate functional and aesthetic characteristics of products, with integral parts and attachment devices. Coordinate Sample submittals for interfacing work.
- D. Include identification on each Sample, with full Project information.
- E. Submit number of Samples specified in individual Specification Sections; Engineer will retain one Sample.
- F. Reviewed Samples that may be used in the Work are indicated in individual Specification Sections.
- G. Samples will not be used for testing purposes unless specifically stated in Specification Section.

1.8 OTHER SUBMITTALS

A. Permits: Within 15 days after date Notice to Proceed, submit a list of permits to be obtained, identifying the granting agency and the required date of permit submittal.

1.9 DESIGN DATA

- A. Informational Submittal: Submit data for Engineer's knowledge as Contract administrator or for Owner.
- B. Submit information for assessing conformance with information given and design concept expressed in Contract Documents.

1.10 TEST REPORTS

- A. Informational Submittal: Submit reports for Engineer's knowledge as Contract administrator or for Owner.
- B. Submit test reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

1.11 CERTIFICATES

- A. Informational Submittal: Submit certification by manufacturer, installation/application Subcontractor, or Contractor to Engineer, in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or product but must be acceptable to Engineer.

1.12 MANUFACTURER'S INSTRUCTIONS

- A. Informational Submittal: Submit manufacturer's installation instructions for Engineer's knowledge as Contract administrator or for Owner.
- B. Submit printed instructions for delivery, storage, assembly, installation, adjusting, and finishing, to Engineer in quantities specified for Product Data.
- C. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.13 ERECTION DRAWINGS

- A. Informational Submittal: Submit Drawings for Engineer's knowledge as Contract administrator or for Owner.
- B. Submit Drawings for information assessing conformance with information given and design concept expressed in Contract Documents.
- C. Data indicating inappropriate or unacceptable Work may be subject to action by Engineer or Owner.

1.14 CONTRACTOR REVIEW

A. Review for compliance with Contract Documents and approve submittals before transmitting to Engineer.

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- B. Contractor: Responsible for:
 - 1. Determination and verification of materials including manufacturer's catalog numbers.
 - 2. Determination and verification of field measurements and field construction criteria.
 - 3. Checking and coordinating information in submittal with requirements of Work and of Contract Documents.
 - 4. Determination of accuracy and completeness of dimensions and quantities.
 - 5. Confirmation and coordination of dimensions and field conditions at Site.
 - 6. Construction means, techniques, sequences, and procedures.
 - 7. Safety precautions.
 - 8. Coordination and performance of Work of all trades.
- C. Stamp, sign or initial, and date each submittal to certify compliance with requirements of Contract Documents.
- D. Do not fabricate products or begin Work for which submittals are required until approved submittals have been received from Engineer.

1.15 ENGINEER REVIEW

- A. Informational submittals and other similar data are for Engineer's information, do not require Engineer's responsive action, and will not be reviewed or returned with comment.
- B. Submittals made by Contractor that are not required by Contract Documents may be returned without action.
- C. Submittal approval does not authorize changes to Contract requirements unless accompanied by Change Order.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 01 33 00

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DIVISION 2 EXISTING CONDITIONS

SECTION 02 41 19 SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Demolishing designated building equipment and fixtures.
 - 2. Demolishing designated construction.
 - 3. Cutting and alterations for completion of the Work.
 - 4. Removing designated items for reuse.
 - 5. Protecting items designated to remain.
 - 6. Removing demolished materials.

1.2 ACTION SUBMITTALS

- A. Section 01 33 00 Submittal Procedures Requirements for submittals.
- B. Demolition Schedule: Indicate overall schedule and interruptions required for utility and building services.
- C. Shop Drawings:
 - 1. Indicate demolition and removal sequence.
 - 2. Indicate location of items designated for reuse.
 - 3. Indicate location and construction of temporary work.

1.3 QUALITY ASSURANCE

- A. Conform to applicable local codes and requirements for demolition work, dust control, products requiring electrical disconnection, re-connection and stair reconnection.
- B. Obtain required permits from authorities having jurisdiction.

1.4 SEQUENCING

- A. Sequence activities in the following order:
 - 1. Scale Trailer
 - a. Remove and properly store the existing stairs for the scale house
 - b. Provide temporary facilities to maintain operation of scale during demolition and reinstallation phase.
 - c. Disconnect/turn off any mechanical, electrical, plumbing (MEP).
 - d. Remove existing scale house.

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- e. Install new scale house trailer.
- f. Re-install existing stairs
- g. Reconnect any corresponding MEP to the new scale trailer.
- 2. Solid Waste Transfer Facility
 - a. Remove and replace column bases and connections one at a time. Provide necessary shoring and temporary supports as needed to accommodate column gravity and lateral loads.
- B. Owner will conduct salvage operations before demolition begins to remove materials Owner chooses to retain.

1.5 SCHEDULING

- A. Schedule Work to coincide with new construction.
- B. Work must be scheduled to maintain operations at the building during construction.
- C. Coordinate utility and building service interruptions with Owner.
 - 1. Do not disable or disrupt building fire or life safety systems without three days prior written notice to Owner.
 - 2. Schedule tie-ins to existing systems to minimize disruption.
 - 3. Coordinate Work to ensure fire sprinklers, fire alarms, smoke detectors, emergency lighting, exit signs and other life safety systems remain in full operation in occupied areas.

1.6 **PROJECT CONDITIONS**

- A. Conduct demolition to minimize interference with adjacent building areas.
- B. Cease operations immediately if structure appears to be in danger and notify Owner's designated construction representative. Do not resume operations until directed.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.1 PREPARATION

- A. Notify affected utility companies before starting work and comply with their requirements.
- B. Mark location and termination of utilities.
- C. Erect, and maintain temporary barriers and security devices including warning signs and lights, and similar measures, for protection of the Owner, and existing improvements indicated to remain.
- D. Erect and maintain weatherproof closures for exterior openings.
- E. Erect and maintain temporary partitions to prevent spread of dust, odors, and noise to permit continued Owner occupancy.

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- F. Prevent movement of structure; provide temporary bracing and shoring required to ensure safety of existing structure.
- G. Provide appropriate temporary signage including signage for exit or building egress.
- H. Do not close or obstruct building egress path.
- I. Do not disable or disrupt building fire or life safety systems without 3 days prior written notice to Owner.

3.2 DEMOLITION

- A. Conduct demolition to minimize interference with adjacent building areas.
- B. Maintain protected egress from and access to adjacent existing buildings at all times.
- C. Do not close or obstruct roadways or sidewalks without permits and Owner approval.
- D. Cease operations immediately when structure appears to be in danger and notify Owner's designated construction representative.
- E. Demolish in orderly and careful manner. Protect existing improvements, supporting structural members and MEP components including Ventilation System.
- F. Carefully remove building components indicated to be reused.
 - 1. Disassemble components as required to permit removal.
 - 2. Package small and loose parts to avoid loss.
 - 3. Mark components and packaged parts to permit reinstallation.
 - 4. Store components, protected from construction operations, until reinstalled.
- G. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.
- H. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.
- I. Remove temporary Work.

3.3 SCHEDULES

- A. Remove, store and protect the following materials and equipment:
 - 1. The existing scale house trailer staircase and landing.
- B. Protect the following materials and equipment remaining:
 - 1. Scale house trailer foundation.
 - 2. Scale house trailer plumbing.
 - 3. Scale house trailer air-conditioning.
 - 4. All elements of the solid waste facility building not to receive work.
- C. Remove the following materials and equipment:
 - 1. The existing scale house trailer.

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END OF SECTION 02 41 19

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DIVISION 3 CONCRETE

SECTION 03 01 90 MODIFICATIONS AND REPAIR TO CONCRETE

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required and cut, remove, repair or otherwise modify parts of existing concrete structures or appurtenances as shown on the Drawings and as specified herein. Work under this Section shall also include bonding new concrete to existing concrete.

1.2 RELATED WORK

- A. Concrete Formwork is included in Section 03 10 00.
- B. Concrete Reinforcement is included in Section 03 20 00.
- C. Cast-in-Place Concrete is included in Section 03 30 00.

1.3 ACTION SUBMITTALS

- A. Submit to the Engineer, in accordance with Section 01 33 00, a schedule of Demolition and the detailed methods of demolition to be used at each location.
- B. Submit manufacturer's technical literature on all product brands proposed for use, to the Engineer for review. The submittal shall include the manufacturer's installation and/or application instructions.
- C. When substitutions for acceptable brands of materials specified herein are proposed, submit brochures and technical data of the proposed substitutions to the Engineer for approval before delivery to the project.

1.4 **REFERENCE STANDARDS**

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C881 Standards Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
 - 2. ASTM C882 Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Sheer.
 - 3. ASTM C883 Standard Test Method for Effective Shrinkage of Epoxy-Resin Systems Used with Concrete.
 - 4. ASTM D570 Standard Test Method for Water Absorption of Plastics.
 - 5. ASTM D638 Standard Test Method for Tensile Properties of Plastics.
 - 6. ASTM D695 Standard Test Method for Compressive Properties of Rigid Plastics.
 - 7. ASTM D732 Standard Test Method for Shear Strength of Plastics by Punch Tool.
 - 8. ASTM D790 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

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B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.5 QUALITY ASSURANCE

- A. No existing structure or concrete shall be shifted, cut, removed, or otherwise altered until authorization is given by the Engineer.
- B. When removing materials or portions of existing structures and when making openings in existing structures, all precautions shall be taken and all necessary barriers, shoring and bracing and other protective devices shall be erected to prevent damage to the structures beyond the limits necessary for the new work, protect personnel, control dust and to prevent damage to the structures or contents by falling or flying debris. Unless otherwise permitted, shown or specified, line drilling will be required in cutting existing concrete.
- C. Manufacturer Qualifications: The manufacturer of the specified products shall have a minimum of 10 years of experience in the manufacture of such products and shall have an ongoing program of training, certifying and technically supporting the Contractor's personnel.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver the specified products in original, unopened containers with the manufacturer's name, labels, product identification and batch numbers.
- B. Store and condition the specified product as recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General
 - 1. Materials shall comply with this Section and any state or local regulations.
- B. Epoxy Bonding Agent
 - 1. General
 - A. The epoxy bonding agent shall be a solvent-free, asbestos-free moisture insensitive epoxy resin material used to bond plastic concrete to hardened concrete complying with the requirements specified herein.
 - 2. Material
 - A. Properties of the cured material
 - 1) Compressive Strength: 8,500 psi minimum at 28 days.
 - 2) Flexural Strength: 1,250 psi minimum at 28 days.
 - 3) Shear Strength: 2,600 psi minimum at 14 days.
 - 4) Bond Strength, Hardened to Plastic: 2,600 psi minimum at 14 days moist cure.

- Approved manufacturers include: Sika Corporation, Lyndhurst, NJ Sikadur 32, Hi-Mod; Sika Corporation, Lyndhurst, NJ – Sika Armatec-110 EpoCem; Master Builder's, Cleveland, OH -Concresive Liquid (LPL) or equal.
- C. Repair Mortar
 - 1. General
 - A. Repair mortal shall be a cement based, fast-setting, trowel grade, structural repair mortar suitable for use on horizontal, vertical and overhead surfaces prepackaged product specifically formulated for the repair of concrete surface defects.
 - 2. Material
 - A. Properties of the cured material:
 - 1) Compressive Strength (1 day) 4,500 psi minimum
 - 2) Compressive Strength (28 days) 7,000 psi minimum
 - 3) Bond Strength (pull off method) 100 percent concrete substrate failure
 - Approved manufacturers include: Sika Corporation, Lyndhurst, NJ SikaRepair 224 or equal.
- D. Adhesive Capsule type anchor system shall be equal to the HIT-HY 200 adhesive Anchoring System by Hilti Fastening Systems, Tulsa, OK. The capsule shall consist of a sealed glass capsule containing premeasured amounts of polyester or vinylester resin, quartz sand aggregate and a hardener contained in a separate vial within the capsule. Where the adhesive anchor is under sustained tensile loading (i.e. vertically installed anchors) the anchor system shall be Hilti HIT RE-500 V3 by Hilti Fastening Systems, Tulsa, OK. All steel reinforcement shall be anchored using the Hilti HIT RE-500 V3 adhesive anchoring system.
- E. Acrylic Latex Bonding Agents shall not be used for this project.
- F. Crack Repair Epoxy Adhesive
 - 1. General
 - A. Crack Repair Epoxy Adhesive shall be a two-component, solvent-free, moisture tolerant epoxy injection adhesive suitable for crack grouting by injection or gravity feed. It shall be formulated for the specific size of opening or crack being injected.
 - 2. Material
 - A. Properties of the cured material
 - 1) Compressive Properties (ASTM D695): 10,000 psi minimum at 28 days.
 - Tensile Strength (ASTM D638): 5,300 psi minimum at 14 days. Elongation at Break
 2 to 5 percent.
 - 3) Flexural Strength (ASTM D790 Modulus of Rupture): 5,400 psi minimum at 14 days
 - 4) Shear Strength (ASTM D732): 3,700 psi minimum at 14 days.

- 5) Water Absorption (ASTM D570 2 hour boil): 1.5 percent maximum at 7 days.
- 6) Bond Strength (ASTM C882): 2,000 psi at 2 days dry; 2,200 psi at 14 days moist
- 3. Approved manufacturers include: Sika Corporation, Lyndhurst, NJ Sikadur 52, or equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Cut, repair, reuse, demolish, excavate or otherwise modify parts of the existing structures or appurtenances, as indicated on the Drawings, specified herein, or necessary to permit completion of the Work. Finishes, joints, reinforcements, sealants, etc., are specified in respective Sections. All work shall comply with other requirements of this of Section and as shown on the Drawings.
- B. All commercial products specified in this Section shall be stored, mixed and applied in strict compliance with the manufacturer's recommendations.
- C. In all cases where concrete is repaired in the vicinity of an expansion joint or control joint the repairs shall be made to preserve the isolation between components on either side of the joint.
- D. When drilling holes for dowels/bolts at new or existing concrete, drilling shall stop if rebar is encountered. As approved by the Engineer, the hole location shall be relocated to avoid rebar. Rebar shall not be cut without prior approval by the Engineer. Where possible, rebar locations shall be identified prior to drilling using "rebar locators" so that drilled hole locations may be adjusted to avoid rebar interference.

3.2 CONCRETE REMOVAL

- A. Concrete designated to be removed to specific limits as shown on the Drawings or directed by the Engineer, shall be done by line drilling at limits followed by chipping or jack-hammering as appropriate in areas where concrete is to be taken out. Remove concrete in such a manner that surrounding concrete or existing reinforcing to be left in place and existing in place equipment is not damaged. Sawcutting at limits of concrete to be removed shall only be done if indicated on the Drawings, or after obtaining written approval from the Engineer.
- B. Where existing reinforcing is exposed due to saw cutting/core drilling and no new material is to be placed on the sawcut surface, a coating or surface treatment of epoxy paste shall be applied to the entire cut surface to a thickness of 1/4-in.
- C. In all cases where the joint between new concrete or grout and existing concrete will be exposed in the finished work, except as otherwise shown or specified, the edge of concrete removal shall be a 1-in deep saw cut on each exposed surface of the existing concrete.
- D. Concrete specified to be left in place which is damaged shall be repaired by approved means to the satisfaction of the Engineer.

3.3 SURFACE PREPARATION

A. Connection surfaces shall be prepared as specified below for concrete areas requiring patching, repairs or modifications as shown on the Drawings, specified herein, or as directed by the Engineer.

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- B. Remove all deteriorated materials, dirt, oil, grease, and all other bond inhibiting materials from the surface by dry mechanical means, i.e. sandblasting, grinding, etc, as approved by the Engineer. Be sure the areas are not less than 1/2-in in depth. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded into parent concrete, subject to the Engineer's final inspection.
- C. If reinforcing steel is exposed, it must be mechanically cleaned to remove all contaminants, rust, etc., as approved by the Engineer. If half of the diameter of the reinforcing steel is exposed, chip out behind the steel. The distance chipped behind the steel shall be a minimum of 1/2-in. Reinforcing to be saved shall not be damaged during the demolition operation.
- D. Reinforcing from existing demolished concrete which is shown to be incorporated in new concrete shall be cleaned by mechanical means to remove all loose material and products of corrosion before proceeding with the repair. It shall be cut, bent or lapped to new reinforcing as shown on the Drawings and provided with a minimum cover all around as specified on the contract drawings or 2-in.
- E. The following are specific concrete surface preparation "methods" to be used where called for on the Drawings, specified herein or as directed by the Engineer. All installation of anchors shall be according to the manufacturer's recommendations.
 - Method A: After the existing concrete surface at connection has been roughened and cleaned, thoroughly moisten the existing surface with water. Brush on a 1/16-in layer of cement and water mixed to the consistency of a heavy paste. Immediately after application of cement paste, place new concrete or grout mixture as detailed on the Drawings.
 - 2. Method B: After the existing concrete surface has been roughened and cleaned, apply epoxy bonding agent at connection surface. The field preparation and application of the epoxy bonding agent shall comply strictly with the manufacturer's recommendations. Place new concrete or grout mixture to limits shown on the Drawings within time constraints recommended by the manufacturer to ensure bond.
 - 3. Method C: Drill a hole 1/4-in larger than the diameter of the dowel. The hole shall be blown clear of loose particles and dust just prior to installing epoxy. The drilled hole shall first be filled with epoxy paste, and then dowels/bolts shall be buttered with paste then inserted by tapping. Unless otherwise shown on the Drawings, deformed bars shall be drilled and set to a depth of ten bar diameters and smooth bars shall be drilled and set to a depth of fifteen bar diameters. If not noted on the Drawings, the Engineer will provide details regarding the size and spacing of dowels.
 - 4. Method D: Combination of Method B and C.
 - 5. Method E: Capsule anchor system shall be set in existing concrete by drilling holes to the required depth to develop the full tensile and shear strengths of the anchor material being used. The anchor bolts system shall be installed per the manufacturer's recommendation in holes sized as required. The anchor stud bolt, rebar or other embedment item shall be tipped with a double 45-degree chamfered point, securely fastened into the chuck of all rotary percussion hammer drill and drilled into the capsule filled hole.

3.4 CRACK REPAIR

- A. Cracks on horizontal surfaces shall be repaired by gravity feeding crack sealant into cracks per manufacturer's recommendations. If cracks are less than 1/16-in in thickness they shall be pressure injected.
- B. Cracks on vertical surfaces shall be repaired by pressure injecting crack sealant through valves sealed to surface with crack repair epoxy adhesive per manufacturer's recommendations.
- C. Cracks shall be repaired according to the following generalized procedure:
 - Remove any efflorescence, dirt, oil, etc., off the surfaces in the vicinity of the observed seepage. Where loose cementitious surfacer/slurry is encountered, it shall be removed to reveal the original concrete surface. Removal shall be performed using mechanical methods chemical solutions provided they are approved by other product manufacturers which are to be used (i.e., paint).
 - 2. Apply adequate surface seal to crack to prevent leakage of epoxy.
 - 3. Establish injection points at a distance along crack not less than thickness of cracked member.
 - 4. Crack injection sequence:
 - 5. Ensure that tank is full of water.
 - 6. Inject epoxy into crack from exterior at first port with sufficient pressure to advance epoxy to adjacent port.
 - 7. Seal original port and shift injection to port where epoxy appears.
 - 8. Continue port-to-port injection until crack has been injected for its entire length.
 - 9. For small amounts of epoxy, or where excessive pressure developed by injection pump might further damage structure, premixed epoxy and use hand caulking gun to inject epoxy if acceptable to the Engineer.
 - 10. Seal ports, including adjacent locations where epoxy seepage occurs, as necessary to prevent drips or run out.
 - 11. The crack is considered to be sealed once no moisture is transferred from the concrete to a dry hand for a minimum of 24 hours after injections. Continue injection procedures if the crack does not meet this condition.
 - 12. After epoxy injection is complete, remove surface seal material and refinish concrete in area where epoxy was injected to match existing concrete including applying new surfacer patch material to match existing in thickness, texture, etc. All materials used for patching or repairs shall be coordinated with other products to be used such as paint to ensure conformance and applicability.

END OF SECTION 03 01 90

SECTION 03 10 00 CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Formwork for cast-in place concrete.
 - 2. Shoring, bracing, and anchorage.
 - 3. Form accessories.
 - 4. Form stripping.
- B. Related Sections:
 - 1. General Notes Sheet of Construction Plans.
 - 2. Concrete reinforcement is included in Section 03 20 00.
 - 3. Cast-In-Place concrete is included in Section 03 30 00.

1.2 **REFERENCES**

- A. American Concrete Institute:
 - 1. ACI 117 Standard Specifications for Tolerances for Concrete Construction and Materials.
 - 2. ACI 301 Specifications for Structural Concrete.
 - 3. ACI 318 Building Code Requirements for Structural Concrete.
 - 4. ACI 347 Guide to Formwork for Concrete.
- B. American Forest and Paper Association:
 - 1. AF&PA National Design Specifications for Wood Construction.
- C. The Engineered Wood Association:
 - 1. APA/EWA PS 1 Voluntary Product Standard for Construction and Industrial Plywood.

1.3 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing in accordance with ACI 318, ACI 301, and ACI 347 to conform to design and applicable code requirements to achieve concrete shape, line and dimension as indicated on Drawings.

1.4 ACTION SUBMITTALS

- A. Section 01 33 00 Submittal Procedures: Requirements for submittals.
- B. Manufacturer's data on proposed form release agent and form ties.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 318, ACI 301, and ACI 347.

B. For wood products furnished for work of this Section, comply with AF&PA.

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 COORDINATION

A. Coordinate this Section with other sections of work, requiring attachment of components to formwork.

PART 2 - - PRODUCTS

2.1 WOOD FORM MATERIALS

- A. Form Materials: At discretion of Contractor.
- B. Lumber Forms:
 - 1. Application: Use for edge forms and unexposed finish concrete.
 - 2. Boards: 6 inches or 8 inches in width, shiplapped or tongue and groove, "Standard" Grade Douglas Fir, conforming to WCLIB Standard Grading Rules for West Coast Lumber. Surface boards on four sides.
- C. Plywood Forms:
 - 1. Application: Use for exposed finish concrete.
 - 2. Forms: Conform to PS 1; full size 4 x 8 feet panels; each panel labeled with grade trademark of APA/EWA.
 - 3. Plywood for Surfaces to Receive Membrane Waterproofing: Minimum of 5/8 inch thick; APA/EWA "B-B Plyform Structural I Exterior" grade.
 - 4. Plywood where "Smooth Finish" is required, as indicated on Drawings: APA/EWA "HD Overlay Plyform Structural I Exterior" grade, minimum of 3/4 inch thick.

2.2 FORMWORK ACCESSORIES

- A. Form Ties: Removable 316 stainless steel metal, fixed length, cone type, 1 or 2 inch back break dimension, free of defects capable of leaving holes larger than 1 inch in concrete surface.
- B. Spreaders: Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face. Wire ties, wood spreaders or through bolts are not permitted.
- C. Form Anchors and Hangers:
 - 1. Do not use anchors and hangers exposed concrete leaving exposed metal at concrete surface.
 - 2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of member.

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- 3. Penetration of structural steel members is not permitted.
- D. Form Release Agent: Colorless mineral oil that will not stain concrete, or absorb
- E. Corners: Chamfer, 3/4 inch on all exposed edges.
- F. Vapor Retarder: Where indicated on Drawings, 10 mil thick polyethylene sheet.
- G. Bituminous Joint Filler: ASTM D1751.
- H. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength and character to maintain formwork in place while placing concrete.
- I. Water Stops: Butyl polymer based sealant. Sika Swellstop or approved equal.

PART 3 - - EXECUTION

3.1 EXAMINATION

- A. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.
- B. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Engineer.

3.2 INSTALLATION

- A. Earth Forms:
 - 1. Trench earth forms neatly, accurately, and at least 2 inches (50 mm) wider than footing widths indicated on Drawings.
 - 2. Trim sides and bottom of earth forms.
 - 3. Construct wood edge strips at top of each side of trench to secure reinforcing and prevent trench from sloughing.
 - 4. Form sides of footings where earth sloughs.
 - 5. Tamp earth forms firm and clean forms of debris and loose material before depositing concrete.
- B. Formwork General:
 - 1. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
 - 2. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
 - 3. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
 - 4. Complete wedging and bracing before placing concrete.
- C. Framing, Studding and Bracing:

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- 1. Space studs at 16 inches on center maximum for boards and 12 inches on center maximum for plywood.
- 2. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
- 3. Construct beam soffits of material minimum of 2 inches thick.
- 4. Distribute bracing loads over base area on which bracing is erected.
- 5. When placed on ground, protect against undermining, settlement or accidental impact.
- D. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301 and ACI 318.
- E. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- F. Obtain Engineer's approval before framing openings in structural members not indicated on Drawings.
- G. Install void forms in accordance with manufacturer's recommendations.

3.3 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.
- C. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer's specifications. Do not coat forms for concrete indicated to receive "scored finish". Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Install formed openings for items to be embedded in or passing through concrete work.
- B. Locate and set in place items required to 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 straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Install water stops continuous without displacing reinforcement.
- F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- G. 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.
- H. Form Ties:
 - 1. Use sufficient strength and sufficient quantity to prevent spreading of forms.

- 2. Place ties at least 1 inch away from finished surface of concrete.
- 3. Leave inner rods in concrete when forms are stripped.
- 4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.
- I. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.
- J. Construction Joints:
 - 1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
 - 2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
 - 3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
 - 4. Arrange joints in continuous line straight, true and sharp.
- K. Embedded Items:
 - 1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
 - 2. Do not embed wood or uncoated aluminum in concrete.
 - 3. Obtain installation and setting information for embedded items furnished under other Specification sections.
 - 4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
 - 5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.
- L. Openings for Items Passing Through Concrete:
 - 1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
 - 2. Coordinate work to avoid cutting and patching of concrete after placement.
 - 3. Perform cutting and repairing of concrete required as result of failure to provide required openings.
- M. Screeds:
 - 1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
 - 2. Slope slabs to drain where required or as shown on Drawings.
 - 3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

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- N. Screed Supports:
 - 1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad or base type screed supports which will not puncture membrane.
 - 2. Staking through membrane is not be permitted.
- O. Cleanouts and Access Panels:
 - 1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
 - 2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.5 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.6 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by Engineer.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store remove forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.
- D. Leave forms in place for minimum number of days as specified in ACI 347.

3.7 ERECTION TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 318.

3.8 FIELD QUALITY CONTROL

- A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.
- B. Notify Engineer after placement of reinforcing steel in forms, but prior to placing concrete.
- C. Schedule concrete placement to permit formwork inspection before placing concrete.

END OF SECTION 03 10 00

SECTION 03 20 00 CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Reinforcing steel bars, wire fabric, and accessories for cast-in-place concrete.

1.2 RELATED SECTIONS

- A. Section 01 30 00 Submittals
- B. Section 03 11 00 Concrete Forming and Accessories
- C. Section 03 30 00 Cast-in-Place Concrete

1.3 REFERENCES

- A. ACI 301 Structural Concrete for Buildings.
- B. ACI SP-66 American Concrete Institute -Detailing Manual.
- C. ANSI/ASTM A1064 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- D. ANSI/AWS D1.4/D1.4M Structural Welding Code for Reinforcing Steel.
- E. ASTM A615 Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- F. CRSI -Concrete Reinforcing Steel Institute -Manual of Practice.
- G. CRSI 63 -Recommended Practice For Placing Reinforcing Bars.
- H. CRSI 65 Recommended Practice For Placing Bar Supports, Specifications, and Nomenclature.
- I. ACI 318 Building code requirements for structural concrete.
- J. ACI 350 Building code requirements for environmental engineering concrete structures.

1.4 ACTION SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 30 00.
- B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 318.
- B. Maintain one copy of document on site.

1.6 COORDINATION

A. Coordinate with placement of formwork, formed openings, and other Work.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615, 60-ksi yield grade; deformed billet steel bars, unfinished.
- B. Welded Steel Wire Fabric: ASTM A1064 Plain Type; in flat sheets unfinished.

2.2 ACCESSORY MATERIALS

- A. Bar supports and accessories shall be of the sizes required to provide the concrete cover specified and shall be of non-corrosive material including, but not limited to, fiberglass, plastic, and/or precast concrete. Where concrete surfaces are exposed to the weather, or liquid in hydraulic structures in finished work, provide plastic accessories only. Use of galvanized or plastic- tipped metal is not permitted in these applications.
- B. Precast concrete bar supports shall use the same class of concrete as specified for the concrete in the structure. The height of the block shall be the height required to provide the cover specified for reinforcing.
- C. The use of wooden bar supports is prohibited.

2.3 FABRICATION

- A. Fabricate concrete reinforcing in accordance with ACI 301 and ACI 318.
- B. Locate reinforcing splices not indicated on drawings, at point of minimum stress. Review location of splices with Engineer.

PART 3 - EXECUTION

3.1 PLACEMENT

- A. Place, support, and secure reinforcement against displacement. Do not deviate from required position. Comply with location tolerances of ACI 301.
- B. Do not displace or damage vapor barrier.
- C. Accommodate placement of formed openings.
- D. Maintain concrete cover around reinforcing according to the construction plans and ACI 318.
- E. Welding of reinforcing bars is prohibited.

END OF SECTION 03 20 00

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all materials, labor, tools, forms, equipment and other items required to place all concrete, reinforcing steel, forms, waterstops and miscellaneous related items including anchor bolts and embedded items as shown in the drawings and described in the specifications.

1.2 RELATED SECTIONS

- A. Section 01 33 00 Submittals
- B. Section 03 10 00 Concrete Forming and Accessories
- C. Section 03 20 00 Concrete Reinforcing

1.3 REFERENCES

- A. The current editions of the following publications shall apply to the extent applicable in each reference:
 - 1. ACI 301 Specifications for Structural Concrete for Buildings
 - 2. ACI 318 Building Code Requirements for Structural Concrete
 - 3. ACI 117 Specifications for Tolerances for Concrete Construction and Materials
 - 4. ACI 305R Hot Weather Concreting
 - 5. ACI 306R Cold Weather Concreting
 - 6. ACI 308 Standard Practice for Curing Concrete
 - 7. ACI 309R Guide to Consolidation of Concrete
 - 8. ACI 304R Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete
 - 9. ACI SP-66 ACI Detailing Manual
 - 10. ASTM C33 Specifications for Concrete Aggregates
 - 11. ASTM C94 Specifications for Ready-mixed Concrete
 - 12. ASTM C150 Specifications for Portland Cement
 - 13. ASTM C260 Specifications for Air Entraining Admixtures for Concrete
 - 14. ASTM C618 Specifications for Pozzolonic Materials

1.4 QUALITY ASSURANCE

- A. Provide the necessary controls to assure the Work will be accomplished in accordance with the contract documents.
- B. Perform Work in accordance with ACI 301.

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- C. Obtain materials from same source throughout the Work.
- D. Storage of all materials shall be such that concrete quality is not affected by storage.

1.5 TESTING LABORATORY SERVICES

- A. Inspection and testing will be performed by an independent testing laboratory under contract with the Contractor in accordance with the Contract Documents.
- B. Testing and analysis of concrete will be performed under provisions of this Section and other related sections.
- C. Provide free access to work and cooperate with the appointed construction inspection firm.

1.6 ACTION SUBMITTALS

- A. Submit proposed mix design of each class of concrete to Engineer for review prior to commencement of work in accordance with Submittal Section. Submittal shall include proposed location for each class of concrete.
- B. Submit manufacturer's technical literature, including application procedures, for the following products:
 - 1. Air entraining agents.
 - 2. Admixtures.
 - 3. Joint sealants.
 - 4. Waterstops.
 - 5. Form-coating materials.
 - 6. Concrete finishing and coating products.
 - 7. Curing materials.
 - 8. Any products proposed for use by the contractor and not specified herein. The engineer reserves the right to reject any proposed products.
- C. Submit test data for the proposed concrete design mix(es). The test data shall be prepared by an independent certified testing laboratory employed and paid for by the contractor. The design mix submittal shall include the following.
 - 1. Three (3), Seven (7) and Twenty-eight (28) day compressive strength results for the specific proposed concrete design mix(es).
 - 2. The manufacturer's technical information for each type of admixture proposed for use on the project.
 - 3. Submit the following flyash information along with the concrete mix design:
 - a. The flyash producer's documentation of quality control procedures and compliance with this specification.
 - b. Complete chemical analyses of the flyash taken at a minimum of quarterly intervals for the preceding year.

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1.7 CODE REQUIREMENTS

A. All concrete construction shall conform to the requirements of ACI 318, Building Code Requirements for Reinforced Concrete and Commentary, and the codes indicated in the References Section of this specification.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. All concrete shall be normal weight concrete weighing not more than 145 pcf with compressive strength(s) at 28 days as described in the following section.
- B. Portland Cement:
 - 1. Structural concrete: ASTM C150 Type II Cement.
- C. Fine and Coarse Aggregates: ASTM C33.
 - 1. Maximum coarse aggregate shall be 1-1/2 inches.
 - 2. Fine aggregates shall be washed natural sand or washed manufactured sand.
- D. Mixing Water: Clean potable water.
- E. Flyash: ASTM C618, Class F.
 - 1. Flyash shall be produced from a single known and consistent source.

2.2 ADMIXTURES

- A. Air Entrainment: ASTM C260. Use Darex II AEA or equal.
- B. Water-reducing admixture may be used and must meet ASTM C-494 as a Type A and Type D. Use WRDA 64 or equal. Add in accordance with ACI-350.
- C. High range water reducing admixture (Superplasticizer): ASTM C494, Type F or Type G.
- D. Use of calcium chloride is not permitted.

2.3 CONCRETE MIX

- A. Mix concrete in accordance with ASTM C94.
- B. Select proportions of ingredients to produce a concrete having proper workability, durability, strength, and appearance. Proportion ingredients to produce a mixture that will work readily into corners and angles of forms and around reinforcement by methods of placing and consolidation employed on the project. Concrete mix shall not allow materials to segregate or allow excess free water to collect on the surface.
- C. Provide concrete to satisfy the following requirements:
 - 1. Minimum cementitious content shall be 515 lbs/cy.
 - 2. Compressive Strength (28 days): 4,000 psi.
 - 3. Water/Cement ratio: 0.45 maximum without admixtures by weight.
 - 4. Proportion admixtures according to the manufacturer's recommendations.

- 5. Air content: $4\% \pm 1\%$.
- 6. Fly Ash Content: maximum 20% by volume of cement volume, Type F only.
- 7. Slump 3 ± 1 inch regular, 7-8 inch with superplasticizer.

2.4 SITE-MIXED CONCRETE

A. Site-mixed concrete shall be used only with the Engineers prior approval.

2.5 CONCRETE CURING MATERIALS

- A. Membrane curing compounds shall conform to ASTM C309 as follows:
 - 1. Solids: 18%.
 - 2. Unit moisture loss: <0.039 gm/cm2 maximum at 72 hours.
 - 3. Rate of application: per the manufacturer or between 150 to 200 sq. ft./gal.
 - 4. Shall be pigmented and free of paraffin or petroleum. It shall not reduce the adhesion of paint, waterproofing or other material to be applied to the concrete.
- B. Polyethylene film for curing concrete shall conform to ASTM C171.
- C. Concrete curing materials shall be compatible with all specified coatings.

PART 3 - EXECUTION

3.1 CONCRETE PLACEMENT

- A. Placement of concrete shall conform to ACI 304R.
- B. Give the Engineer 48 hours notice prior to concrete placements. No concrete shall be placed on any subgrade or in any formwork until the subgrade, formwork, reinforcing steel, anchor bolts and other imbedded items have been inspected and approved by the Engineer.
- C. The Contractor shall so plan his concrete work in such a manner that once started it can be carried on as a continuous operation until a section, panel or unit is completed. Construction joints other than the ones shown on the drawings must be approved by the Engineer prior to placing concrete.
- D. Concrete shall be placed in daylight except where required for continuous pours of such quantity to necessitate night placing. In such cases, the Contractor shall provide adequate lighting so as to carry on operations to the satisfaction of the Engineer.
- E. Footing concrete shall be cast in forms of the sizes and elevations indicated. If dry, all earth or rock surfaces that contact concrete shall be sprayed to avoid absorption of moisture from the concrete. No footing concrete shall be poured until soil and compaction are approved by the Engineer.
- F. Footing and slab subgrade materials encountered that are judged unsuitable by the Engineer shall be removed and replaced with suitable granular material.
- G. All footing and slab bearing soil surfaces shall be compacted in accordance with the recommendations in the geotechnical report, but not less than a density of at least 95 percent of

standard maximum density as determined in accordance with AASHTO Specification T-180, latest revision, a test being made in each lift of compacted fill and/or one foot into the original soil.

- H. Before depositing new concrete on or against concrete that has set, existing surface shall be thoroughly roughened and cleaned of laitance, foreign matter and loose particles. Forms shall be re-tightened and existing surfaces covered with a bonding agent in accordance with the manufacturer's requirements.
- I. Concrete shall be conveyed to forms as rapidly as practicable without segregation or loss of ingredients. Concrete shall be conveyed to the point of placing continuously and at such a rate that no unfinished area will be left exposed or unworked before the concrete takes its initial set.
- J. When concrete is conveyed by chutes, there shall be a continuous flow of concrete. The chute shall be of metal or metal-lined wood, with sections set at approximately the same slope; namely, not less than the discharge end of the chute shall be provided with a drop chute to prevent segregation. If the height of the discharge end of the chute is more than 3 times the thickness of the layer being deposited, but not more than 5 feet above surface of concrete in forms, a spout shall be used, and the lower end maintained as near the surface of deposit as practicable. When pouring is intermittent, the chute shall discharge into a hopper. The chute shall be thoroughly cleaned before and after each run. Waste material and flushing water shall be discharged outside the forms. Raised runways for wheeling concrete to its place shall be provided when necessary.
- K. Drop chutes, elephant trunks, and/or tremies shall be used in walls and columns. Drop chutes, elephant trunks and tremies shall be moved at short intervals during the pour. Vibrators shall not be used in lieu of proper movement of this equipment. Tremies shall be used for underwater pours and to avoid segregation. Locate chutes or flex pipes so that concrete is delivered in a continuous flow to points not more than five feet horizontally or five feet vertically from its final location.
- L. Pumping equipment shall be compatible with the slump and aggregate size specified. Aluminum pump lines are unacceptable.
- M. In pouring concrete through reinforcement, care shall be taken that no segregation of the coarse aggregate occurs. Deposit concrete continuously or in layers so that no concrete will be placed on concrete that has hardened sufficiently to cause formation of seams or other planes of weakness.
- N. Concrete shall be placed in layers not over 18 inches deep and each layer shall be compacted by mechanical internal-vibrating equipment supplemented by hand-spading, rodding and tamping, as directed by the Engineer. Vibrators shall be in no case used to transport concrete inside forms.
- O. Vibrators shall conform to ACI 309R. Use of form vibrators will not be permitted. Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the concrete. At least one spare vibrator shall be maintained as a relief. The duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing objectionable segregation. The vibrator shall not be inserted into lower courses that have begun to set. When absorptive form lining is used, the vibrator shall not be placed between the forms and the outer row of reinforcement, and in no case shall the vibrator be allowed to touch the

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absorptive form lining. Vibrators shall be applied at uniformly spaced points not farther than the visible effectiveness of the machine.

- P. Do not place concrete during rain, sleet, snow, or freezing weather.
- Q. Do not permit rainwater to increase mixing water or to damage the surface finish. If rainfall occurs after placing operations begin, provide adequate covering to protect the work.
- R. Hot Weather:
 - 1. Conform to ACI 305R.
 - 2. The hot weather concreting plan shall be submitted to the engineer for review.
 - 3. The maximum permissible temperature of concrete during placement is 95°F.
 - 4. Cold Weather:
 - 5. Conform to ACI 306R.
 - 6. When the temperature is 40°F and rising, concrete may be placed as long as the water and/or aggregate is heated so that the concrete temperature is at least 55°F at the time of the pour. The placed concrete shall be maintained at 50°F minimum for 7 days minimum.
 - 7. The cold weather concreting plan shall be submitted to the engineer for review.

3.2 INSPECTION

A. Verify reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.3 CONCRETE FINISHING

- A. Repairing Surface Defects
 - 1. Repair surface defects immediately after the removal of forms.
 - 2. Remove honeycombed and other defective concrete down to sound concrete and repair with repair mortar as submitted to and approved by the engineer.
 - 3. Patch tie holes immediately after removal of forms. Fill solid with repair mortar as submitted to and approved by the engineer.
 - 4. The contractor shall submit patching materials and methods of application to the engineer for approval.
- B. Finishing of Formed Surfaces
 - 1. Rough-form finish shall be in accordance with ACI 301.
 - 2. Smooth-form finish shall be in accordance with ACI 301.
 - 3. Smooth-rubbed finish shall be in accordance with ACI 301. A smooth-rubbed finish requires an initial smooth-form finish as required above.
 - 4. Tops of walls and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed. Float unformed surfaces to a texture consistent with

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that of the formed surfaces. Final treatment of formed surfaces shall continue uniformly across the unformed surfaces.

- C. Finishing Slabs and Similar Flat Surfaces
 - 1. Use strike-off templates or approved compacting-type screeds riding on screed strips or edge forms to bring concrete surface to the proper contour.
 - 2. Thoroughly consolidate concrete in slabs.
 - 3. Floated Finish: Use float finish for the following:
 - a. Interior exposed horizontal surfaces of liquid containers, except those to receive grout topping.
 - b. Exterior below grade horizontal surfaces.
 - c. Surfaces to receive additional finishes, except as shown or specified.
 - 4. Troweled finish: Use trowel finish for the following:
 - a. Interior exposed slabs, unless otherwise shown or specified.
 - b. Slabs to receive resilient floor finishes.
 - c. To obtain a troweled finish, a floated finish as specified above must be applied. After power floating, use a power trowel to produce a smooth surface that is relatively free of defects, but may still contain some trowel marks. Do additional troweling by hand after the surface has hardened sufficiently. Do final troweling when a ringing sound is produced as the trowel is moved over the surface. Thoroughly consolidate the surface by hand-troweling operations.
 - d. Produce a finished surface free of trowel marks, uniform in texture and appearance, and conforming to ACI 117, section 4.8.6.1, ¹/₄" tolerance.
 - 5. To obtain a broom, belt, or rake finish, immediately upon completing a floated finish, draw a broom or rake across the surface to give a coarse, transverse- scored texture.

3.4 TESTING AND CONTROL FURNISHED BY THE CONTRACTOR

- A. Floor, Horizontal, or Slab irregularities shall comply with ACI 117 4.8.6, Table 4.8.6.1 "Manual straightedge method" for Floor surface classification "Conventional"
- B. The commercial testing laboratory will be required to perform the following:
 - 1. Samples for strength tests of each class of concrete placed each day shall be taken not less than each concrete pour event, nor less than every 50 cy of concrete placed.
 - 2. Conduct strength tests for concrete according to the following procedures.
 - a. Secure samples according to ASTM C172.
 - b. Mold four specimens from each sample according to ASTM C31. Cure under standard moisture and temperature conditions as specified in ASTM C31.
 - c. Test one specimen at 3 days, one at 7 days and two at 28 days according to ASTM C39. If

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one or both of the 28-day tests indicate a compressive strength

- d. below the strength required, the fifth specimen shall be tested at 56 days. If all tests indicate a compressive strength below the strength required, the engineer may direct the contractor to perform testing of in-place concrete at no additional cost to the owner, regardless of the outcome of the tests.
- 3. Determine the following when test cylinders are taken:
 - a. Air content.
 - b. Slump.
 - c. Concrete temperature.
- 4. Tests shall be performed on concrete taken near the beginning of pours.
- C. The commercial testing laboratory shall also perform additional testing as required by the engineer.
- D. The testing laboratory facilities shall be made available for inspection during normal working operations. Provide a laboratory testing schedule of the work so that breaking of cylinders can be witnessed by the engineer, if necessary.
- E. The contractor shall notify the commercial testing laboratory 24 hours prior to any required testing.
- F. In addition to the initial mix design, the contractor will be required to employ, at no charge to the owner, a commercial testing laboratory, acceptable to the owner, to prepare and test the design mix for each class of concrete for which the material source has been changed.

3.5 TESTING OF DEFICIENT IN-PLACE CONCRETE

- A. The strength of the concrete will be considered potentially deficient if the averages of two consecutive sets of strength test results fail to equal or exceed the specified strength or if any individual strength test result falls below the specified strength. Testing may be required as directed by the engineer.
- B. Concrete work not having the required strength, as determined by the engineer, shall be replaced at the contractor's expense.
- C. The contractor shall bear all costs incurred in providing the additional testing and/or analyses required as a result of deficient in-place concrete. All costs as a result of delays due to additional testing and/or analyses will be at the contractor's expense, with no extension of contract length, regardless of the outcome of the testing.

3.6 ACCEPTANCE OF CONCRETE WORK

- A. Formed surfaces resulting in a configuration of members smaller than permitted under the tolerances specified herein shall be considered deficient and repaired or replaced as directed by the engineer.
- B. Concrete members cast in the wrong location shall be rejected if the strength, appearance, or function of the structure is, in the engineer's opinion, adversely affected or if misplaced members

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interfere with other construction. If rejected, remove members cast in the wrong location and repair or replace at the contractor's expense as directed by the engineer.

C. All work required under this section shall be at the contractor's expense, with no extension of contract length.

3.7 FIELD QUALITY CONTROL

A. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.8 CURING

- A. Curing shall conform to ACI 308.
- B. Protect freshly deposited concrete from premature drying, excessively hot or cold temperatures, and excessive moisture loss for a period of time necessary for the hydration of the cement and proper hardening of the concrete.
- C. Curing shall begin immediately following the initial set of concrete or surface finishing has been completed, as soon as surface marring will not occur as a result of curing operations.
- D. Wall forms may be left in place as a means of curing unless the weather is hot and dry. Consult with the engineer concerning weather conditions acceptable for leaving wall forms in place. Cure concrete immediately after the removal of forms in hot and dry weather, in accordance with the requirements and procedures specified herein.
- E. During the curing period, protect concrete from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration. Protect finished concrete
- F. surfaces from damage caused by construction equipment, materials, or methods, and by rain or running water.
- G. Wood forms and covering materials shall be kept sufficiently wet with clean water to reduce cracks and to prevent form joints from opening, and to prevent hair line cracks in concrete surfaces.

END OF SECTION 03 30 00
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DIVISION 5 METALS

SECTION 05 12 00 STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 09 96 00 High Performance Coating Shop Primers and Steel Coatings

1.2 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
 - 2. Shrinkage-resistant grout.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Require representatives of each entity directly concerned with structural steel framing to attend, including the following:
 - a. Contractor's superintendent.
 - b. Steel Subcontractor.

1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Shop primers and topcoats shall be in accordance with Section 09 96 00.

1.5 ACTION SUBMITTALS

- A. Product Data:
 - 1. Structural-steel materials.
 - 2. High-strength, bolt-nut-washer assemblies.
 - 3. Anchor rods.
 - 4. Threaded rods.
 - 5. Shop primer.

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- 6. Etching cleaner.
- 7. Galvanized repair paint.
- 8. Shrinkage-resistant grout.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment Drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
 - 5. Identify members not to be shop primed.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M for each welded joint whether prequalified or qualified by testing, including the following:
 - 1. Power source (constant current or constant voltage).
 - 2. Electrode manufacturer and trade name, for demand-critical welds.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator, shop-painting applicators, and testing agency.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural-steel materials, including chemical and physical properties.
- E. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.

1.7 CODES AND STANDARDS

- A. Florida Building Code, Seventh Edition (2020).
- B. AISC "Codes of Standard Practice for Steel Buildings and Bridges".
- C. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", including "Commentary" and Supplements thereto as issued.
- D. AISC "Specifications for Structural Joints using ASTM A 325 or A490 Bolts" approved by the Research Council on Structural Connections of the Engineering Foundation.
- E. AWS D1.1 "Structural Welding Code".

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- F. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".
- G. S.S.P.C. Society for Protective Coatings.
- H. Occupational Safety and Health Act (OSHA), as amended to date.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector.
- C. Shop-Painting Applicators: Qualified in accordance with AISC's Sophisticated Paint Endorsement P1 or to SSPC-QP 3.
- D. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.
 - Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 **PERFORMANCE REQUIREMENTS**

- A. Comply with applicable provisions of the following specifications and documents:
 - 1. ANSI/AISC 303.
 - 2. ANSI/AISC 341.

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- 3. ANSI/AISC 360.
- 4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A992/A992M.
- B. Channels, Angles-Shapes: ASTM A36/A36M.
- C. Plate and Bar: ASTM A36/A36M.
- D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade B, ASTM A500/A500M, Grade C, and ASTM A1085/ASTM A1085M structural tubing.
- E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.
- F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

2.4 RODS

- A. Headed Anchor Rods: ASTM F1554, Grade 36, straight.
 - 1. Nuts: ASTM A563 (ASTM A563M) heavy-hex carbon steel.
 - 2. Plate Washers: ASTM A36/A36M carbon steel.
 - 3. Washers: ASTM F436 (ASTM F436M), Type 1, hardened carbon steel.
 - 4. Finish: Plain.

2.5 PRIMER

- A. Steel Primer:
 - 1. See Section 09 96 00.

2.6 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.

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- 3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
- 4. Mark and match-mark materials for field assembly.
- 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 1.
- F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.8 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.9 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M, where indicated in the construction drawings.
 - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

2.10 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

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- 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
- 2. Surfaces to be field welded.
- 3. Surfaces of high-strength bolted, slip-critical connections.
- 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
- 5. Galvanized surfaces unless indicated to be painted.
- 6. Surfaces enclosed in interior construction.
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
 - 1. SSPC-SP 2.
- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner or in accordance with SSPC-SP 16.
- D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.11 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage a qualified testing agency to perform shop tests and inspections.
 - 2. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
 - 3. Bolted Connections: Inspect shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 - 4. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E165/E165M.
 - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E164.
 - d. Radiographic Inspection: ASTM E94/E94M.
 - 5. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
 - 1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 - 2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
 - a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1) Liquid Penetrant Inspection: ASTM E165/E165M.
 - 2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 3) Ultrasonic Inspection: ASTM E164.
 - 4) Radiographic Inspection: ASTM E94/E94M.

3.6 **PROTECTION**

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- C. Touchup Priming: Cleaning and touchup priming are specified in Section 09 96 00 "High Performance Coatings".

END OF SECTION 05 12 00

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DIVISION 8 OPENINGS

SECTION 08 33 23 HIGH PERFORMANCE OVERHEAD HIGH SPEED DOORS

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
 - A. High Performance Exterior Overhead High Speed Rubber Doors.
- 1.2 RELATED SECTIONS
 - A. Section 05500 Metal Fabrications: Support framing and framed opening.

1.3 REFERENCES

- A. ASTM A 36 Standard Specification for Carbon Structural Steel.
- B. ASTM A 500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- C. ASTM E 283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- D. ASTM E 330 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- E. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- F. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
- G. UL Listed Underwriters Laboratories Inc. Product Listed.
- 1.4 DESIGN / PERFORMANCE REQUIREMENTS
 - A. Single-Source Responsibility: Provide doors, guides, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.
 - B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.
- 1.5 SUBMITTALS

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- A. Submit under provisions of Section 01 33 00.
- 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. Details of door materials, construction and fabrication.
 - 4. Operating characteristics, electrical characteristics, and furnished accessories. Include automatic closing devices and testing and resetting instructions
 - 5. Installation instructions.
- C. Shop Drawings: Include detailed plans, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction.
- D. Selection Samples: For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors and finishes.
- E. Verification Samples: For each finish specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and finishes.
- F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- G. Closeout Submittals: Provide manufacturer's maintenance instructions Including a detailed parts lists and maintenance recommendations.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of 3 years experience in the fabrication and installation of security closures.
- B. Installer Qualifications: Installer Qualifications: Company specializing in performing Work of this section with minimum 2 years and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

- C. Store materials in a dry, warm, ventilated weathertight location.
- 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 absolute limits.
- 1.9 COORDINATION
 - A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.
- 1.10 WARRANTY
 - A. Warranty: Manufacturer's limited door warranty and operator system, except the finish, to be free of defects in material and workmanship for 5 years.
- PART 2 PRODUCTS
- 2.1 MANUFACTURERS
 - A. Acceptable Manufacturer: Wayne Dalton; 2501 S. State Highway 121 Business, Suite 200, Lewisville, TX 75067. ASD. Phone: (800) 827-3667; Web Site: <u>www.wayne-dalton.com</u>. Email: info@wayne-dalton.com.
 - B. Acceptable Manufacturer: Overhead Door Corporation, 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972) 906-1499. Web Site: <u>www.overheaddoor.com</u>. Email: <u>arcat@overheaddoor.com</u>.
 - C. Rytec Corporation, One Cedar Parkway, W223N16601 Cedar Parkway, Jackson, WI 53037. Tel. Toll Free: (888) 467-9832. Fax: (262) 677-2058. Web Site: <u>www.rytecdoors.com</u>.
 - D. Requests for substitutions will be considered.
- 2.2 HIGH PERFORMANCE EXTERIOR HIGH SPEED OVERHEAD RUBBER DOORS
 - A. Models:
 - 1. Wayne Dalton ADV-X 885
 - 2. Overhead Door Rapidflex Model 995
 - 3. Rytec Fast-Seal

- 4. Rytec Powerhouse SD
- 5. Approved equivalent extreme exterior high speed rubber door
 - a. Performance:
 - 1) Opening Speed: Door to operate at a variable speed up to 50 inches (1270 mm) per second (control system dependent).
 - 2) Closing Speed: Door to operate at a variable speed up to 40 inches (1016 mm) per second.
 - 3) Operation Cycles: Drive motor and gearbox capable of operating for not less than 1,000,000 cycles. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- B. Materials and Components:
 - 1. Door Curtain Design:
 - a. Door Curtain: High strength curtain, as follows.
 - 1) Butadiene Rubber with polyester weave or
 - 2) Multi-layered Rylon material
 - b. Curtain Retainers: Curtain retained by polyethylene continuous wind locks at both edges of the panel to remain engage inside the guides under static and dynamic pressures.
 - 2. Bottom Bar: Break away bottom bar full width of the opening, sufficient to maintain bottom edge of curtain parallel to the door threshold.
 - a. Upon impact, bottom bar releases from Guides and door operation is stopped. Controller must indicate problem encountered and instruct operator on steps to fix the problem. Detection must be achieved via a solid state device for accuracy, no external electromechanical switch is allowed.
 - 1) Door must automatically reset itself after impact by pressing a button on control panel.
 - 2) Provide door with wireless failsafe electric safety edge.
 - 3) Break away detection sensitivity must be field adjustable

- 3. Guides: Construct of high strength steel with members fully bolted together.
 - a. Door shall have no visible air gaps along the side or top of the door when door panel is in the closed or down position.
- 4. Door Header: Top roll assembly fabricated of high strength steel barrel supported high strength steel brackets at each end with self-aligning bearings.
 - a. Springless system: No balancing springs or counterweights permitted.
- 5. Hood: Top roll assembly enclosed with an external metal hood.
 - a. Finish: Galvanized steel hood with black polyester top coat.
 - b. Material: 22 gauge steel with intermediate supports as required.
- 6. Electric Door Operator: UL listed.
 - a. Usage Classification: Heavy duty, rated up to 60 cycles per hour under constant load.
 - b. Motor Exposure: Exterior and Interior use.
 - c. Direct Side Mounted: Operator mounted directly to door drive shaft to the left or right side of the door. No chain and sprocket allowed.
 - d. Electrical Characteristics:
 - 1) Phase and Voltage:
 - a) 3-Phase 208-245V AC
 - b) 3-Phase 440-480V AC
 - c) 3-Phase 575V AC
 - 2) Hertz: 50/60.
 - e. Operator: Minimum 1.0 horsepower. Motor and gearbox designed for high cycle operation with built-in gearbox failure door stop safety device
 - f. Hand Chain: Manual brake disengagement pull switch and hand chain which allows door to be manually opened and closed during a power outage and installation.

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- g. Limit System: Magnetic type providing absolute positioning with push to set and remote setting capabilities. Limit system shall remain synchronized with the door during manual operation and supply power interruptions.
- h. Timer to Close: Each door to have automatic closing controlled by an adjustable hold open time delay.
- 7. Control System:
 - a. Control system is housed in a NEMA 4X panel with built-in push buttons and main power padlock-able rotary disconnect switch.
- 8. Activation Devices: Provide for condition of exposure and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.
 - a. Pedestrian Type Activation Devices:
 - 1) Three Push Button Switch: Button for open, button for close, button for stop.
 - 2) Pull Cord: Pull to Open Pull to Close.
 - 3) Motion Sensor: Field adjustable wide angle.
 - a) Differentiates between pedestrian and vehicular traffic.
 - b) Prevents false activation from cross traffic,
 - c) Remote control for set-up.
 - b. Vehicular Type Activation Devices:
 - 1) Motion Sensor: Field adjustable wide angle.
 - a) Differentiates between pedestrian and vehicular traffic.
 - b) Prevents false activation from cross traffic,
 - c) Remote control for set-up.
 - 2) Pull Cord: Pull to Open Pull to Close.
- 9. Safety Devices: Provide for condition of exposure and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated. Coordinate safety devices with door operation and door operator mechanisms.

- a. Door provided with two sets of Through Beam Photo Eyes located in plane or as close as possible to travelling path of the door curtain.
- b. Door provided with monitored failsafe electric safety edge. Controller must indicate if the safety edge is not operable.
 - 1) Connections between safety edge and controller shall be fully wireless. No coil cords allowed.
 - 2) Bottom bar wireless system battery must be able to be replaced at ground level.
- 10. Finish Requirements:
 - a. Galvanized Steel: Hood galvanized in accordance with ASTM A 653 and receive rustinhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on black polyester top coat.

PART 3 - EXECUTION

- 3.1 EXAMINATION
 - A. Verify opening sizes, tolerances and conditions are acceptable.
 - B. Verify site electrical characteristics and supplies.
 - C. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.
 - D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

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- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Coordinate installation of electrical service. Complete wiring from disconnect to unit components.
- F. Coordinate installation of sealants and backing materials at frame perimeter.
- G. Install perimeter trim and closures.
- H. Instruct Owner's personnel in proper operating procedures and maintenance schedule.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.5 ADJUSTING

- A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.
- B. Adjust hardware and operating assemblies for smooth and noiseless operation.
- C. Adjust seals to provide tight fit around entire perimeter.

3.6 CLEANING

- A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.
- B. Remove labels and visible markings.
- C. Touch-up, repair or replace damaged products before Substantial Completion.

3.7 DEMONSTRATION

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

3.8 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION 08 33 23

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100% TECHNICAL SPECIFICATIONS

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DIVISION 9 FINISHES

SECTION 09 96 00 HIGH PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Not used.

1.2 SUMMARY

- A. Provide all labor, materials, apparatus, scaffolding, and all appurtenant work in connection with painting and protective coatings, complete as indicated, specified and required.
- B. Principal items to be coated per PART 3 of this document include, but are not limited to:
 - 1. Interior Primary Structural Steel
 - 2. Exterior Concrete (Lower Walls)
 - 3. Existing Steel Hopper Frames
 - 4. Owner-Designated Metals, Pipes and Appurtenances
- C. In addition to the application of coatings, the following procedures are to be performed:
 - 1. Not Used
- D. It is the Contractor's responsibility to examine areas and conditions under which coating systems are to be applied, and to notify the Owner's designated representative of areas or conditions which are not acceptable. Do not begin surface preparation or application until areas or conditions have been corrected.
- E. Description of Options Contained within this specification are the following Options:
 - 1. Not Used.

1.3 DEFINITIONS

- A. Owner Lee County Solid Waste Department, or their appointed representative.
- B. Specifier Specifying engineer, architect, or consulting firm.
- C. Contractor Selected contractor who is awarded the project.
- D. Manufacturer Coating manufacturer or manufacturer's authorized representative:
 - 1. Basis of Specification: Tnemec Company, Inc., represented by Florida Protective Coatings Services, Inc.
- E. DFT Dry film thickness
- F. Mils All listed mils are dry film thicknesses.
- G. Paint and Coating The words "Paint" and Coating" may be used interchangeably within this document to refer to paints and high-performance coatings.

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1.4 ACTION SUBMITTALS

- A. Section 01 33 00 Submittal Procedures: Requirements for submittals.
- B. Product Data Sheets.
 - 1. Contractor shall submit coating material manufacturer's printed technical data sheets for products intended for use in each coating system.
 - Data sheets shall fully describe material as to its intended use, generic description, recommended surface preparation and application conditions, primers, material mixing and application (including recommended dry mil thickness recoat time), precautions, safety and maintenance cleaning directions.
- C. Safety Data Sheets. Safety Data Sheets (SDS) shall accompany all submittals and shall be easily available for access at the job site during all activities.
- D. Project references as outlined in Article 1.6.
- E. Copy of any required certificates, to demonstrate compliance with Article 1.6.
- F. Coating Schedule: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 ONE MANUFACTURER

A. All coatings shall be the product of one manufacturer as specified in this document.

1.6 QUALITY ASSURANCE

- A. Third party Inspection:
 - 1. Owner reserves the right to utilize third-party inspection services on this project.
 - 2. If utilized, initial third-party inspection services shall be provided at no additional cost to the Contractor.
- B. Guarantee
 - A one (1) year guarantee against failure which commences on the date of final completion shall be provided for all coatings, unless more stringent requirements are specified hereinafter. Failure of any coating during the guarantee period shall be repaired by the Contractor who shall absorb all costs related to the repair of the coating. Failure shall be defined as peeling, blistering, delamination or loss of adhesion of any of the coatings.
- C. Manufacturer's Qualifications:
 - 1. Specialize in manufacture of high-performance coatings with a minimum of 100 years successful experience.
 - 2. Able to demonstrate successful performance on comparable projects.
 - 3. Single-Source Responsibility: All coatings shall be products of a single manufacturer.
- D. Manufacturer's Representative:

- 1. The Contractor shall require the manufacturer to furnish a manufacturer's qualified technical representative to visit the project site for technical support as required and ordered and as may be necessary to resolve field questions or problems attributable to or associated with the manufacturer's products furnished under this Contract or the application thereof.
- E. Applicator's Qualifications:
 - 1. Applicator must have a minimum NACE Level 1-certified inspector on staff for no less than 6 months.
 - 2. Experience in application of specified coatings for a minimum of 5 years on projects of similar size and complexity to this work.
 - 3. Applicator must comply with all relevant OSHA safety regulations.
 - 4. Use best practices to carry out corrosion prevention activities in the field.
 - 5. Use best practices in environmental protection to prevent environmental degradation, and to ensure careful handling of all hazardous materials.
 - 6. The Contractor must submit, with their bid, a letter of recommendation from the basis of design product manufacturer. This letter shall confirm that the Contractor's ability to apply the specified coatings.
 - 7. The Contractor must submit, with their bid, a list of a minimum five (5) completed projects of similar size and complexity to this work. Include for each project:
 - a. Project name & location
 - b. Name and contact of owner
 - c. Name and contact of specifier
 - d. Approximate area of coatings applied
 - e. Total project amount value
 - f. Date of completion
- F. Pre-Application Meeting:
 - 1. A pre-application meeting shall be held at least two (2) weeks before the start of application of coating systems. All parties who directly affect the project shall attend, including the Contractor, Manufacturer, and Owner.
 - 2. The pre-application meeting shall include a review of any circumstances which may impact the project including, but not limited to, the following:
 - a. Environmental requirements
 - b. Protection of Surfaces not scheduled to be coated
 - c. Surface Preparation
 - d. Ventilation
 - e. Application

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- f. Cleaning
- g. Disinfection
- h. Repair
- i. Field Quality Control
- j. Protection of coating systems
- k. 11-month walkthrough
- I. Coordination of other projects
- G. 11-Month Walkthrough:
 - 1. The Owner shall organize a project meeting for 11 months after the final completion date which the Contractor, Manufacturer, and Owner shall attend. Participants will perform a walkthrough of the project and resolve any workmanship or materials discrepancies.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. All coatings shall be delivered to the mixing room in unbroken containers, bearing the manufacturer's brand, date of manufacture, and name. They shall be used without alteration and mixed, thinned, and applied in strict accordance with manufacturer's directions for the applicable materials and surface before using.
- B. Coatings shall be delivered to the job site in the original unopened containers, bearing the manufacturer's label. A Product Data Sheet and Safety Data Sheets for all coatings shall be obtained from the manufacturer for each shipment of materials to the job site. Coatings shall be stored in a dry, well-ventilated area, not in direct contact with the ground, where the temperature is maintained within the manufacturer's written recommended limits.
- C. Damaged materials and/or materials exceeding the shelf life shall not be used.
- D. The Contractor will be responsible for storing coatings onsite in accordance with the Manufacturer's latest written recommendations.
- E. Coatings shall be mixed in proper containers of adequate capacity. All coatings shall be mixed in accordance with the Manufacturer's latest written recommendations. No unauthorized thinners or other materials shall be added to any coatings. Air shall not be used directly for agitation. Pigmented material shall be strained after mixing. Catalyzed materials may not be used beyond the recommended pot life.
- F. Work areas will be designated by the Owner for storage and mixing of all materials. Materials shall be in full compliance with the requirements of pertinent codes and fire regulations. Proper containers outside of the buildings shall be provided and used for wastes, and no plumbing fixture shall be used for this purpose.
- G. Contractor will be responsible for disposal of all waste, empty containers, etc.
- H. All recommendations of the Manufacturer in regard to the health and safety of workmen shall be followed.

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1.8 FIELD CONDITIONS

- A. All coatings shall be applied in dry and dust-free environment.
- B. No coating shall be applied when temperatures are outside the manufacturers written recommended limits.
- C. No coating shall be applied to wet or damp surfaces, and shall not be applied in rain, fog, or mist.
- D. No coating shall be applied when the temperature is less than 5°F above the dew point.
- E. No coating shall be applied when unsuitable environmental conditions are expected within 1 hour of the listed "Dry to Touch" time for a coating.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Coatings shall be a product of Tnemec, or Specifier Approved Equal. Tnemec coatings are listed as a quality standard. Alternate coatings of other manufacturers may be approved by the Specifier, provided they are equal or better.
 - 1. Local Tnemec Contact: Chad Holmes (727) 201-6706, cholmes@tnemec.com
- B. To allow time for Specifier and Owner review, all requests for substitution shall be submitted by the coating manufacturer a minimum of ten (10) days prior to the project bid date.

2.2 PROTECTIVE COATINGS, GENERAL

- A. A specified basis of design is intended to provide the longest service life possible, lowest life cycle cost and most sustainable solution. Contractors must provide pricing based on the basis of design. If submitting alternate products, this must be shown in the Bid Schedule as an ADD or DEDUCT to the overall Base Bid, so the Owner can decide which coating system to accept.
- B. Potential alternate products must include side-by-side comparisons of equality including generic coating description, volume solids, ASTM performance test results, etc.
- C. Substitutions which decrease the total film thickness, change the generic type of coating, or fail to meet the performance criteria of the specified materials shall not be approved.
- D. All coatings shall be furnished by the same manufacturer.
- E. Coatings shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer, all of which shall be plainly legible at the time of use.
- F. All coatings shall be produced and applied as herein called for or, if not specifically called for, it shall be applied in accordance with the manufacturer's latest printed recommendations as approved by the Specifier.
- G. Coating materials shall meet Volatile Organic Compounds (VOC) requirements of not more than 3.5 lbs/gal after thinning.
- H. No coatings containing lead will be allowed.
- I. Material Compatibility:

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- 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
- 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- J. Colors: All colors and shades of colors of all coats of material shall be as identified in the color schedule. Each coat shall be of a slightly different shade, as directed by the Manufacturer to facilitate inspection of surface coverage of each coat.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Coatings: Owner reserves the right to invoke the following procedure:
 - Owner will engage the services of a qualified testing agency to sample coatings. Contractor will be notified in advance and may be present when samples are taken. If coatings have already been delivered to project site, samples may be taken at project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coatings from project site, pay for testing, and repaint surfaces that were coated with rejected materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.
- B. The Contractor shall conduct wet film thickness measurements and shall recoat and repair as necessary for compliance with the specifications.
- C. Coating thickness shall be determined by the use of a properly calibrated "Nordson-Mikrotest" or "Positest" Coating Thickness Gauge (or equal) for metal. Note that a "Tooke" gauge may also be used if necessary, and that use of the "Tooke" gauge is classified as a destructive test.
- D. Before performing any destructive tests on a newly applied coating system, the Owner and Contractor shall determine which of them is responsible for the cost of repairing the damaged coatings.
- E. Coatings not in compliance with the specifications will not be acceptable and shall be corrected and re-inspected at Contractor's expense until the specifications are met.
- F. After each coat has been allowed to dry, the dry film thickness will be measured and recorded in the daily inspection reports. The Contractor shall not apply a successive coat until the dry film thickness of the preceding coat or coats has been approved by the Owner.

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- G. Measurement of dry film thickness over steel surfaces will be done in accordance with SSPC-PA
 2.
- H. Measurement of dry film thickness over concrete surfaces may be estimated by comparison of the used material to the theoretical coverage rate.
- I. Holiday Testing:
 - 1. Not Used.

3.2 PREPARATION

- A. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- B. General (ALL Surfaces):
 - 1. All surfaces are to receive the following surface preparation prior to any other specified surface preparations in the remainder of Article 3.2.
 - 2. The Contractor shall examine all surfaces to be coated, and shall correct all surface defects before application of any coatings. Any required removal, repair, or replacement of this work caused by unsuitable conditions shall be done at no additional cost to the Owner.
 - 3. All weld seams, sharp protrusions and edges shall be ground smooth prior to the surface preparation or application of any coatings.
 - 4. Remove all loose existing coatings, dirt, dust, grease, oil, mold, mildew, salts, and other soluble contaminants by High Pressure Water Cleaning (using potable water, 3500 5000 psi, 3-5 gallons / minute, oscillating tip). A degreaser may be required for oil-soaked areas or heavily contaminated areas.
 - 5. Neutralize and remove all mold & mildew using a solution made by adding two (2) ounces of tri-sodium phosphate and eight (8) ounces of sodium hypochlorite to one (1) gallon warm water. Use a scouring powder, if necessary, to remove mildew spores, and then perform a final rinse with potable water.
 - 6. Concrete Crack Repairs: V-Groove cracks a minimum ¼ inch and patch with Tnemec Series 215 or Series 218. Fill and strike smooth.
 - 7. Concrete Spall repairs: Repair spalls in accordance with ICRI Guideline No.310.1R. Areas to be repaired are to be prepared in accordance with SSPC-SP13/NACE No.6 with a minimum surface profile of ICRI-CSP5. Series 218 shall be used for shallow concrete repairs. For deeper repairs, Series 217 may be used. Exposed steel rebar is to be prepared in accordance with SSPC-SP10/NACE No.2, and primed the same day using Tnemec Series N69 @ 4.0 6.0 mils DFT.
 - 8. All surfaces must be clean, dry, and free of contaminants prior to the application of any coatings.

- 9. All prepared surfaces must be coated as soon as possible in order to prevent recontamination of the substrate. Areas which are re-contaminated must be re-cleaned to the proper level of cleanliness prior to application of coatings. If necessary, this may also involve re-sandblasting, which will be performed at no additional cost to the Owner.
- C. Interior & Exterior Ferrous Metals (Structural Steel):
 - 1. Prepare all surfaces in accordance with Article 3.2.B.
 - 2. Abrasive blast or mechanically abrade in accordance with SSPC-SP6 Commercial Blast Cleaning to provide a minimum 1.5 mil angular anchor profile.
- D. Interior Ferrous Metals (Existing Steel Hopper Frames):
 - 1. Prepare all surfaces in accordance with Article 3.2.B.
 - Minimum surface preparation of bare steel or previously painted steel requires a cleanliness level as defined by SSPC-SP WJ-4/NACE WJ-4 Light Cleaning by use of Low Pressure Water Cleaning (LP WC) between 3,500 and 5,000 psi using a 0 degree rotating nozzle.
 - 3. If all visible contaminates, loose mill scale, loose rust and other corrosion products, and loose paint have not been removed, SSPC-SP2 Hand Tool Cleaning or SSPC-SP3 Power Tool Cleaning should be employed until the surface cleanliness definition is met.
 - 4. Remove all loose coatings and lifted edges.
 - 5. Feather edges of well-adhered preexisting coatings.
 - 6. All surfaces must be clean, dry, and contaminant-free.
- E. Exterior Concrete (Lower Walls):
 - 1. Prepare all surfaces in accordance with Article 3.2.B.
- F. Owner-Designated Exterior Ferrous Metals:
 - 1. Prepare all surfaces in accordance with Article 3.2.B.
 - 2. Remove all loose coatings and lifted edges.
 - 3. Feather edges of well-adhered preexisting coatings.
 - 4. Prepare areas of bare metal in accordance with SSPC-SP2 or SSPC-SP3 Hand or Power Tool Cleaning.
 - 5. Abrade all glossy areas with medium grit sandpaper or similar to thoroughly and uniformly scarify and de-gloss all surfaces, and to create a uniform angular anchor profile.
- G. Owner-Designated Exterior PVC/HDPE Pipes:
 - 1. Prepare all surfaces in accordance with Article 3.2.B.
 - 2. Abrade all glossy or bare areas with medium grit sandpaper or similar to thoroughly and uniformly scarify and de-gloss all surfaces, and to create a uniform angular anchor profile.

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3.3 COATING SCHEDULE

- A. Interior & Exterior Ferrous Metals (Structural Steel):
 - 1. 1st Coat: Series 90-97 @ 2.5 3.5 mils. If desired, Series 90G-1k97 may instead be utilized at the same thickness.
 - 2. Pit Filler: Apply Series 215 as needed to fill angular pits and voids, and small holidays which are unable to be filled using the specified high-performance coatings. The pit filler may be thickened in accordance with the manufacturer's recommendations.
 - 3. 2nd Coat: Series N69 @ 4.0 8.0 mils.
 - 4. 3rd Coat: Series 1074 @ 3.0 5.0 mils. If desired, Series 72 or Series 1094 may also be utilized at the same thickness.
- B. Interior Ferrous Metals (Existing Steel Hopper Frames):
 - 1. Pit Filler: Apply Series 215 as needed to fill angular pits and voids, and small holidays which are unable to be filled using the specified high-performance coatings. The pit filler may be thickened in accordance with the manufacturer's recommendations.
 - 2. 1st Coat: Series 118 @ 6.0 8.0 mils.
 - 3. 2nd Coat: Series 118 @ 6.0 8.0 mils.
 - 4. 3rd Coat: Series 1028 @ 2.0 3.0 mils.
- C. Exterior Concrete:
 - 1. Stripe Coat: Brush Series 154 in to fill hairline cracks.
 - 2. Patcher/Filler: Fill wider cracks and bring all surfaces to level and repair voids, depressions, and areas of lost concrete using Series 154 Acrylic Emulsion. Clean 50/70 mesh sand may be uniformly mixed into Series 154 (2:1 sand:resin ratio is recommended) for spot repairs where a thicker consistency is required to achieve the desired texture, application, and film build properties. To blend the texture, wait at least 8 hours and then apply an additional 10.0 mils of Series 154 without aggregate.
 - 3. 1st Coat: Series 151 @ 1.0 1.5 mils.
 - 4. 2nd Coat: Series 1026 @ 2.0 3.0 mils.
 - 5. 3rd Coat: Series 1026 @ 2.0 3.0 mils.
- D. Owner-Designated Exterior, UV-Exposed Ferrous Metals (pipes, conduits, etc):
 - 1. Spot Prime (Bare Ferrous Metals Only): Series N69 @ 4.0 8.0 mils.
 - 2. Pit Filler: Apply Series 215 as needed to fill angular pits and voids, and small holidays which are unable to be filled using the specified high-performance coatings. The pit filler may be thickened in accordance with the manufacturer's recommendations.
 - 3. Prime: Series N69 @ 3.0 5.0 mils.

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- 4. Finish: Series 1074 @ 3.0 5.0 mils. If desired, Series 72 or Series 1094 may also be utilized at the same thickness.
- E. Owner-Designated Exterior, UV-Exposed PVC/HDPE (pipes, conduits, etc):
 - 1. Prime: Series 1074 @ 2.0 5.0 mils. If desired, Series 72 or Series 1094 may also be utilized at the same thickness.
 - 2. Finish: Series 1074 @ 2.0 5.0 mils. If desired, Series 72 or Series 1094 may also be utilized at the same thickness.

3.4 COLOR SCHEDULE

A. Colors are TBD at this time.

3.5 APPLICATION

- A. Apply all paints and coatings in accordance with the Manufacturer's latest written instructions and recommendations.
 - 1. Use applicators and techniques suited for coatings and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation of new or removed permanently fixed items, coat surfaces behind these items.
 - 3. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Each coat must be tinted a different shade to facilitate identification of each coat when multiple coats are required. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform finish, color, and appearance.
- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Sufficient time shall be allowed to elapse between successive coats to permit satisfactory recoating but, once commenced, the entire coating operation shall be completed without delay. Contractor is responsible for compliance with the Manufacturer's listed minimum and maximum recoat windows.

3.6 FIELD QUALITY CONTROL

- A. The Contractor shall regularly conduct wet film thickness measurements and shall recoat and repair as necessary for compliance with the specifications.
- B. On metal substrates, coating thickness shall be determined by the use of a properly calibrated "Nordson-Mikrotest" or "Positest" Coating Thickness Gauge (or equal). Please note that a "Tooke" gauge may be used on cementitious surfaces, and that use of the "Tooke" gauge is classified as a destructive test.

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- C. Before performing any destructive tests on a newly applied coating system, the Owner and Contractor shall determine which of them is responsible for the cost of repairing the damaged coatings.
- D. Coatings not in compliance with the specifications will not be acceptable and shall be replaced and re-inspected at Contractor's expense until the specifications are met.

3.7 COATING PERFORMANCE CRITERIA

- A. The following shall serve as a basis of comparison for material substitution requests. Any substitutions which decrease the total film thickness, change the generic type of coating, or fail to meet the performance criteria of the specified materials shall not be approved.
 - 1. Series N69 Hi-Build Epoxoline II Polyamidoamine Epoxy:
 - a. Adhesion: ASTM D4541 No less than 1,943 psi (13.40 MPa) pull, average of three tests.
 - b. Exterior Exposure: ASTM D1014 No blistering, cracking, checking, rusting or delamination of film. No rust creepage at scribe after 5 years exposure.
 - c. Humidity: ASTM D4585 No blistering, cracking, checking, rusting or delamination of film after 10,000 hours exposure.
 - d. Immersion: ASTM D870 No blistering, cracking, rusting or delamination of film after 2,000 hours continuous immersion in deionized water at 140°F, average of three tests.
 - e. Prohesion: ASTM G85 No blistering, cracking, checking, rusting or delamination of film. No more than 1/8" rust creepage at scribe after 5,000 hours exposure.
 - f. Salt Spray: ASTM B117 (2 Coats Series N69) No blistering, cracking or delamination of film. No more than 1% rusting on plane. No more than 1/16" rust creepage at scribe after 6,700 hours exposure.
 - g. Salt Spray: ASTM B117 (Series 90-97 with 2 Coats Series N69) No blistering, cracking, rusting or delamination of film. No more than 1% rusting on plane. No more than 3/16" rust creepage at scribe after 20,000 hours exposure.
 - 2. Series 90-97 Tneme-Zinc Aromatic Zinc-Rich Urethane:
 - a. Zinc Pigment: 83% by weight in dried film
 - b. Adhesion: ASTM D4541 (Type II) No less than 1,516 psi (10.46 MPa) adhesion, average of three tests.
 - c. Adhesion: ASTM D4541 (Type V) No less than 2,083 psi (14.36 MPa) adhesion, average of three tests.
 - d. Prohesion: ASTM G85 No blistering, cracking or delamination of film. No more than 1/64" rust creepage at scribe after 15,000 hours exposure.
 - e. Salt Spray: ASTM B117 No blistering, cracking or delamination of film. No more than 1/8" creepage at scribe and no more than 1% rusting on plane after 50,000 hours exposure.

- 3. Series 118 Uni-Bond Mastic Mastic Waterborne Acrylic:
 - a. VOC Content: 0.26 lbs/gallon
 - b. Adhesion: ASTM D4541 (Applied over exterior aged aliphatic polyurethane) No less than 1,000 psi bond strength to the aged aliphatic polyurethane system.
 - c. Cyclic Salt Fog/UV Exposure: ASTM D5894 No blistering, cracking, rusting or delamination of the film and no creepage at the scribe after 5,376 hours.
 - d. Humidity: ASTM D2247 No blistering or rusting after 5,000 hours.
 - e. Tensile Strength, Elongation, Modulus of Elasticity: ASTM D412 (Method C) Not less than 436 psi (3.00) tensile strength, and 237% elongation at break.
 - f. Water Vapor Transmission: ASTM D1653 (Method B Wet Cup) No more than 15.71 g/m² per 24 hours water vapor transmission and no more than 1.23 perms water vapor permeance.
- 4. Series 215 Surfacing Epoxy Modified Polyamine Epoxy
 - a. VOC Content: 0.08 lbs/gallon
 - b. Adhesion: ASTM D7234 (Method B): Exceeds the cohesive strength of the concrete substrate (400 psi).
 - c. Adhesion: ASTM D4541 Not less than 2,226 psi (15.35 MPa) pull, average of three tests.
 - Compressive Strength: ASTM C579 No less than 9,183 psi (63.3 MPa) compressive strength, average of five tests.
 - e. Flexural Strength and Modulus of Elasticity: C580 No less than 4,330 psi (29.9 MPa) flexural strength and 324,877 psi (2,240 MPa) flexural modulus of elasticity, average of six tests.
 - f. Flexural Strength and Modulus of Elasticity: ASTM D790 No less than 10,630 psi (73.29 MPa) flexural strength and 87,440 psi (602.88 MPa) flexural modulus of elasticity, average of three tests.
 - g. Tensile Strength, Elongation, Modulus of Elasticity: ASTM C307 No less than 2,280 psi (15.72 MPa) tensile strength, average of six tests.
 - h. Tensile Strength, Elongation, Modulus of Elasticity: ASTM D2370 No less than 2,011 psi (13.86 MPa) tensile strength, 304,213 psi (2,102 MPa) tensile modulus of elasticity and 1.04% elongation, average of ten tests.
 - Water Absorption: ASTM C413 No weight gained after 2 hours continuous boiling water immersion, average of three tests.
- 5. Series 1074 EnduraShield Aliphatic Acrylic Polyurethane:
 - a. Abrasion: ASTM D4060 (CS-17 Wheel, 1,000 gram load) No more than 116 mg loss after 1,000 cycles.

- Exterior Exposure: ASTM D4141 Method C (EMMAQUA) No blistering, cracking or chalking. No less than 70% gloss retention (26 units gloss change) and 0.07 DED Hunter Lab Scale color change (white) after 500 MJ exposure.
- c. QUV Exposure: ASTM D4587 (UVA-340 bulbs, Cycle 4:8 hours UV/4 hours condensation) No blistering, cracking, chalking or delamination of film. No less than 96% gloss retention (3 units gloss change) and 0.42 DED FMCII (MacAdam units) color change (white) after 2,000 hours exposure.
- d. Salt Spray: ASTM B117 No blistering, cracking, rusting or delamination of film. No more than 1/64 inch rust creepage at scribe after 5,000 hours exposure.
- 6. Series 1026 Enduratone Acrylic Emulsion:
 - a. VOC Content: 0.38 lbs/gallon (1.4 grams/litre)
 - QUV Exposure: ASTM D4587 (UVA-340 bulbs, 8 hours UV, 4 hours condensation) No blistering, cracking, chalking or delamination of film. No less than 49% gloss retention (2.3 units gloss change) and 0.39 DE00 color change after 10,000 hours exposure.
 - c. Water Vapor Transmission: ASTM D1653 (Method B Wet Cup) No more than 359.24 g/m² per 24 h water vapor transmission and no more than 25.05 perms water vapor permeability, average of three tests.
- 7. Series 1028 Enduratone HDP Acrylic Polymer:
 - a. VOC Content: 0.79 lbs/gallon (94 grams/litre)
 - b. Algal Resistance: ASTM D5589 No more than traces of algal growth (less than 10%) after three weeks continuous exposure.
 - c. Fungal/Mold/Mildew Resistance: ASTM D5590 No more than traces of fungal growth (less than 10%) after four weeks continuous exposure.
 - d. QUV Exposure: ASTM D4587 (UVA-340 bulbs, 8 hours UV, 4 hours condensation) No blistering, cracking or delamination of film. No less than 72% gloss retention, no more than 0.69 DE00 color change and no more than 22 units gloss loss after 3,000 hours.
 - e. Salt Spray (Fog): ASTM B117 No blistering, cracking, rusting or delamination of film. No more than 3/16" (5 mm) rust creepage at scribe after 5,000 hours exposure.
 - f. Scrubbability: ASTM D4213 No more than 112 mg loss after 1,000 cycles, average of three tests.

3.8 CLEANING AND PROTECTION

A. Upon completion of the work, staging, scaffolding, drop-cloths, and containers shall be removed from the site or destroyed in an approved manner. Paint spots, oil, or stains upon adjacent surfaces shall be removed.

END OF SECTION 09 96 00

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100% TECHNICAL SPECIFICATIONS

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DIVISION 13 Special Construction

SECTION 13 34 19 METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 03 30 00 Cast-In-Place Concrete
- C. Section 09 96 00 High Performance Coatings

1.2 SUMMARY

- A. Section Includes:
 - 1. Structural-steel framing.
 - 2. Metal roof panels.
 - 3. Metal wall panels.
 - 4. Metal soffit panels.
 - 5. Thermal insulation.
 - 6. Personnel doors and frames.
 - 7. Accessories.

1.3 DEFINITIONS

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

1.4 COORDINATION

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

1.5 REFERENCES

- A. American Institute of Steel Construction (AISC):
 - 1. AISC 360 Specification for Structural Steel Buildings.
 - 2. AISC 341 Seismic Provisions for Structural Steel Buildings (when appropriate).
 - 3. AISC Design Guide 3 Serviceability for Steel Buildings

- B. American Iron and Steel Institute (AISI):
 - 1. AISI S100 North American Specification for the Design of Cold-Formed Steel Structural Members.
- C. American Welding Society (AWS):
 - 1. AWS D1.1 / D1.1M Structural Welding Code Steel.
 - 2. AWS D1.3 / D1.3M Structural Welding Code Sheet Steel.
- D. Association for Iron & Steel Technology (AISE):
 - 1. AISE 13 Specifications for Design and Construction of Mill Buildings.
- E. ASTM International (ASTM):
 - ASTM A 325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - ASTM A 653 / A 653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - ASTM A 792 / A 792M Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - 4. ASTM B 117 Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - 5. ASTM C 518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 6. ASTM C 1363 Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.
 - 7. ASTM D 522 Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
 - 8. ASTM D 523 Standard Test Method for Specular Gloss.
 - ASTM D 968 Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.
 - 10. ASTM D 1308 Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
 - 11. ASTM D 2244 Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
 - 12. ASTM D 2247 Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
 - ASTM D 2794 Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
 - 14. ASTM D 3361 Standard Practice for Unfiltered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
 - 15. ASTM D 4214 Standard Test Methods for Evaluating the Degree of Chalking of Exterior

Paint Films.

- 16. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- 17. ASTM E 96 / E 96M Standard Test Methods for Water Vapor Transmission of Materials.
- 18. ASTM E 331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- 19. ASTM E 1592 Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
- 20. ASTM E 1646 Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
- 21. ASTM G 87 Standard Practice for Conducting Moist SO2 Tests.
- F. FM Global:
 - 1. FMRC Standard 4471 Approval Standard for Class 1 Roofs for Hail Damage Resistance, Combustibility, and Wind Uplift Resistance.
- G. Metal Building Manufacturers Association (MBMA):
 - 1. MBMA Metal Building Systems Manual.
 - 2. Seismic Design Guide for Metal Building Systems.
- H. North American Insulation Manufacturers Association (NAIMA):
 - 1. NAIMA 202 Standard For Flexible Fiber Glass Insulation to be Laminated for Use in Metal Buildings.
- I. The Society for Protective Coatings (SSPC):
 - 1. SSPC-Paint 15 Primer for Use Over Hand Cleaned Steel performs to SSPC-Paint 15 standards.
 - 2. SSPC-SP2 Hand Tool Cleaning.
- J. Underwriters Laboratories (UL):
 - 1. UL 580 Standard for Tests for Uplift Resistance of Roof Assemblies.
 - 2. UL 723 Standard for Test for Surface Burning Characteristics of Building Materials.
- K. US Army Corps of Engineers (COE):
 - 1. COE Unified Facilities Guide Specification Section 07 61 13.
- L. 2020 Florida Building Code, 7th Edition:
 - 1. Building.
 - 2. Energy Conservation.

1.6 DEFINITIONS

A. Building Width: Measured from outside to outside of sidewall girts. Typically edge to edge of

concrete.

- B. Building Length: Measured from outside to outside of end wall girts. Typically edge to edge of concrete
- C. Building Line: Outside face of steel/girt.
- D. Building Eave Height: Measured from the top of the eave member at the outside of the sidewall girt line to the bottom of the sidewall column base plate or to finished floor if columns are on grout or recessed below finished floor.
- E. Bay Spacing: Measured from centerline to centerline of primary frames for interior bays and from centerline of the first interior frame to outside of end wall girts for end bays.
- F. Roof Pitch: The ratio of the vertical rise to the horizontal run (i.e. 1:12 = 1 inch of rise for every foot of horizontal dimension).

1.7 ACTION SUBMITTALS

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

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- a. Show wall-mounted items including personnel doors, overhead doors, louvers, exhaust fans, and lighting fixtures.
- 4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:8)
 - a. Flashing and trim.
 - b. Gutters.
 - c. Downspouts.
- C. Samples for Initial Selection: For units with factory-applied finishes.
- D. Samples for Verification: For the following products:
 - 1. Panels: Nominal 12 inches (300 mm) long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
 - 2. Vapor-Retarder Facings: Nominal 6-inch- (150 mm) square Samples.
 - 3. Flashing and Trim: Nominal 12 inches (300 mm) long. Include fasteners and other exposed accessories.
 - 4. Accessories: Nominal 12-inch- (300-mm-) long Samples for each type of accessory.
- E. Door Schedule: For doors and frames. Include details of reinforcement.
 - 1. Door Hardware Schedule: Include details of fabrication and assembly of door hardware. Organize schedule into door hardware sets indicating complete designations of every item required for each door or opening.
 - 2. Keying Schedule: Detail Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.
- F. Delegated-Design Submittal: For metal building systems.
 - 1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

1.8 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For erector and manufacturer.
- B. Welding certificates.
- C. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
 - 1. Name and location of Project.
 - 2. Order number.
 - 3. Name of manufacturer.
 - 4. Name of Contractor.
 - 5. Building dimensions including width, length, height, and roof slope.

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- 6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for coldrolled steel, including edition dates of each standard.
- 7. Governing building code and year of edition.
- 8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
- 9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
- 10. Building-Use Category: Indicate category of building use and its effect on load importance
- D. Erector Certificates: For qualified erector, from manufacturer.
- E. Material Test Reports: For each of the following products:
 - 1. Structural steel including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shop primers.
 - 5. Nonshrink grout.
- F. Source quality-control reports.
- G. Field quality-control reports.
- H. Surveys: Show final elevations and locations of major members. Indicate discrepancies between actual installation and the Contract Documents. Have surveyor who performed surveys certify their accuracy.
- I. Sample Warranties: For special warranties.

1.9 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panel finishes and door hardware to include in maintenance manuals.

1.10 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
 - 1. Experience: Not less than five (5) years experience in the actual production of specified products
 - 2. Member of the Metal Building Manufacturer's Association (MBMA).
 - 3. Primary manufacturer of frames, secondary steel, roof and wall sheeting, and trim.
 - Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.
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- B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
 - 1. Acceptable to or licensed by manufacturer.
 - 2. Three (3) years experience with systems.
 - 3. Successfully completed not less than five (5) comparable scale projects using this system.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel."
 - 2. AWS D1.3, "Structural Welding Code Sheet Steel."
- D. Land Surveyor Qualifications: A professional land surveyor who practices in jurisdiction where Project is located and who is experienced in providing surveying services of the kind indicated.
- E. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Build mockups for typical wall metal panel including accessories.
 - a. Size: 48 inches long by 48 inches.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.11 DELIVERY, STORAGE, AND HANDLING

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

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1.12 FIELD CONDITIONS

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

1.13 WARRANTY

- A. Manufacturer shall warranty installed system for the periods described herein, starting from Date of Substantial Completion or ninety days from delivery, whichever comes first, against all the conditions indicated below. When notified in writing from Owner, manufacturer/installer shall, promptly and without inconvenience and cost to Owner, correct said deficiencies.
 - 1. Materials and Workmanship Warranty:
 - a. Warranty Period: five (5) years.
- B. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.
- C. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.
 - 1. Warranty Period: Twenty (20) years from date of Substantial Completion.
 - 2. Panel Rib Standard Weathertight Warranty:
 - a. Warranty Period: 10 years, standard.
 - 3. Structural Endorsement:
 - a. Warranty Period: 20 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 SYSTEM DESCRIPTION

- A. General:
 - 1. Provide metal building frame, metal wall panels, metal roof panels, accessories and miscellaneous materials for a complete enclosure including supports for building components

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specified in other sections.

- 2. Design structural systems according to professionally recognized methods and standards and legally adopted building codes.
- 3. Design under supervision of professional engineer licensed in the jurisdiction of the Project.
- B. Primary-Frame Type:
 - 1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.
- C. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable.
- D. Secondary-Frame Type: Manufacturer's standard purlins and joists and flush-framed.
- E. Eave Height: As indicated by nominal height on Drawings.
- F. Bay Spacing: As indicated on Drawings.
- G. Roof Slope: 1/2 inch per 12 inches (1:24)
- H. Roof System: Manufacturer's standard standing-seam, vertical-rib, metal roof panels.
- I. Exterior Wall System: Manufacturer's standard exposed-fastener, tapered-rib, metal wall panels.
 - 1. Liner Panels: Tapered rib. (South wall only)

2.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, registered in the jurisdiction of the project, to design metal building system.
- B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
 - 1. Design Loads: As indicated on Drawings.
 - Deflection and Drift Limits: Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."
- C. Seismic Performance: Metal building system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Range: 100 degrees F (37 degrees C) in a 24-hour period.
- E. Fire-Resistance Ratings: Where assemblies are indicated to have a fire-resistance rating, provide metal panel assemblies identical to those of assemblies tested for fire resistance per ASTM E119 or ASTM E108 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

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- 1. Indicate design designations from UL's "Fire Resistance Directory," FM Global's "Approval Guide," or from the listings of another qualified testing agency.
- F. Fire Propagation Characteristics: Exterior wall assemblies containing foam plastics pass NFPA 285 fire test.
- G. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
- H. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 - 1. Wind Loads: As indicated on Drawings.
- I. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E1646 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- J. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- K. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for winduplift-resistance class indicated.
 - 1. Uplift Rating: UL 90.
- L. Thermal Performance for Opaque Elements (Conditioned Break Room): Provide the following maximum U-factors and minimum R-values when tested according to ASTM C1363 or ASTM C518:
 - 1. Roof:
 - a. R-Value: R-19 Minimum
 - 2. Walls:
 - a. R-Value: R-13 Minimum.

2.4 STRUCTURAL-STEEL FRAMING

- A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."
- B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

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- D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
 - 1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
 - a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.
 - 2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
 - 3. Frame Configuration: Single gable.
 - 4. Exterior Column: Tapered.
 - 5. Rafter: Tapered.
- E. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
 - 1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
 - 2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
- F. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either coldformed, structural-steel sheet or roll-formed, metallic-coated steel sheet, to comply with the following:
 - 1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; with minimum yield strength of 60,000 psi (410 MPa); simple span or continuous span as required for design.
 - a. Depth: As needed to comply with system performance requirements.
 - 2. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structuralsteel shapes; with minimum yield strength of 60,000 psi (410 MPa); simple span or continuous span as required for design. G-90 galvanized standard material
 - a. Depth: As required to comply with system performance requirements
 - 3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
 - 4. Flange Bracing: Minimum 2-by-2-by-1/8-inch (51-by-51-by-3-mm) structural-steel angles or 1inch- (25-mm-) diameter, cold-formed structural tubing to stiffen primary-frame flanges.
 - 5. Sag Bracing: Minimum 1-by-1/by-1/8-inch (25-by-25-by-3-mm) structural-steel angles.

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- 6. Base or Sill Angles: Manufacturer's standard base angle, minimum 3-by-2-inch (76-by-51-mm), fabricated from zinc-coated (G90 galvanized) steel sheet.
- 7. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
- 8. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
- 9. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from coldformed, structural-steel sheet; built-up steel plates; designed to withstand required loads.
- G. Canopy Framing: Manufacturer's standard structural-framing system, designed to withstand required loads; fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide frames with attachment plates and splice members, factory drilled for field-bolted assembly.
- H. Bracing: Provide adjustable wind bracing using any method.
- I. Anchor Rods: Headed anchor rods as indicated in Drawings for attachment of metal building to foundation.
- J. Materials:
 - 1. Hot Rolled Steel Shapes: W, M and S shapes, angles, rods, channels and other shapes; ASTM A 500, ASTM A 572/A 572M or ASTM A 36/A 36M as applicable; with minimum yield strengths required for the design.
 - Structural Steel Plate, Bar, Sheet, and Strip for Use in Bolted and Welded Constructions: ASTM A 572/A 572M, A 529/A 529M, A 1011 or A 36/A 36M Modified 50, with minimum yield strength of 55,000 psi (380 MPa).
 - 3. Steel Pipe: ASTM A53/A53M, Type E or S, Grade B.
 - 4. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B or C, structural tubing.
 - Structural-Steel Sheet: Hot-rolled, ASTM A1011/A1011M, Structural Steel (SS), Grades 30 through 55 (205 through 380), or High-Strength Low-Alloy Steel (HSLAS) or High-Strength Low-Alloy Steel with Improved Formability (HSLAS-F), Grades 45 through 70 (310 through 480); or cold-rolled, ASTM A1008/A1008M, Structural Steel (SS), Grades 25 through 80 (170 through 550), or HSLAS, Grades 45 through 70 (310 through 480).
 - Metallic-Coated Steel Sheet: ASTM A653/A653M, SS, Grades 33 through 80 (230 through 550), or HSLAS or HSLAS-F, Grades 50 through 80 (340 through 550); with G90 (Z275) coating designation.
 - 7. Structural Bolts and Nuts Used with Primary Framing: High strength, ASTM A 325 bolts and ASTM A563 Grade DH nuts and ASTM F436, Type 1, hardened washers.
 - 8. Bolts and Nuts Used with Secondary Framing Members: High Strength ASTM A 325 Bolts and ASTM A 563 Grade C nuts and ASTM F436, Type 1, hardened washers.
 - 9. Anchor Rods: ASTM F1554, Grade 55.

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- a. Configuration: Straight.
- b. Nuts: ASTM A563 (ASTM A563M) heavy-hex carbon steel.
- c. Plate Washers: ASTM A36/A36M carbon steel.
- d. Washers: ASTM F436 (ASTM F436M) hardened carbon steel.
- K. Finish: Refer to Section 09 96 00

2.5 METAL ROOF PANELS

- A. Standing-Seam, Vertical-Rib, Metal Roof Panels: Formed with vertical ribs at panel edges; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
 - Roof Panels: "SSR" Standing Seam Roof Panels; 24 inches wide net coverage, with 3 inches high major ribs formed at the panel side laps, formed for field seaming using electrically operated seaming machine.
 - a. Side joints: Factory applied sealant.
 - b. Material: AZ50 Galvalume coated steel.
 - c. Thickness: 24 gauge (0.58 mm).
 - d. Standard Roof pitches ranges from 1/4 inch:12 up to 4 inches:12
 - e. Side laps: Two factory-formed interlocking ribs, with one weather sealed joint, fieldseamed into place to form a double-fold 360 degree seam.
 - f. Length: Continuous from eave to ridge up to 55 feet in length.
 - g. End laps, where required: 4 inches wide, located at a support member.
 - h. Panel-to-roof purlin structural attachments: SSR clips with movable tabs which interlock with seamed SSR panel ribs and provide for panel movement in either direction from center of clip to compensate for thermal effects.
 - i. SSR Ridge; draw-formed aluminum seam caps factory-attached to SSR ridge panels that are seamed together along the center of the ridge, utilizing only one weather sealed joint and providing a expansion joint for panel movement.
 - j. Rake edge of roof shall be attached to the building structure in a manner which will allow thermal expansion of the SSR roof panels along the gables and will provide the uplift resistance required by code.
 - k. SSR roof will meet the requirements for UL Class 90 wind uplift and FM Class 1-60, 1-75, 1-90 and 1-120. Certification includes IAS.
 - Roof panel finish shall be a dispersion coating based on Kynar 500 FSF PVDF resin that meets the performance criteria of AAMA 2605. The coating shall be applied to the galvalume coated steel by an applicator approved by the formulator and shall contain a minimum of 70 percent by weight of Kynar 500 FSF resin. Dry film thickness, ASTM D1400: 0.20 mil primer coat plus 1.0 mil barrier, 1.0 mil color coat, 2.20 mil total minimum

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thickness.

- m. Exposed fasteners are stainless steel capped painted to match roof color.
- SSR roof will meet the requirements for UL Class 90 wind uplift. Certification includes IAS and Miami-Dade County Florida product approval. FM Class 1 Roof Assembly, Class A Fire classification (ASTM E 108).
- 2. Clips: To accommodate thermal movement.
- 3. Joint Type: Mechanically seamed.
- 4. Panel Coverage: 24 inches maximum.
- 5. Panel Height (Major Ribs): 3 inches (77 mm).

2.6 METAL WALL PANELS

- A. Exposed-Fastener, Tapered-Rib, Metal Wall Panels: Formed with raised, trapezoidal major ribs and designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
 - 1. Material: AZ50 Galvalume coated steel.
 - 2. Thickness: 24 gauge.
 - 3. Side laps: Two fully overlapping major ribs secured together with Stainless Steel capped 1/4 inch diameter color-matched carbon steel fasteners.
 - 4. Length: Continuous from sill to eave up to 43 feet in length.
 - 5. End laps, where required: 4 inches wide, located at a support member.
 - 6. Crimp panels at the base to achieve no gaps against the foundation greater than 1/16 inch and notch to match roof panel configuration at the eave.
 - 7. Cut panels square at each end.
 - 8. Cut panels square at each end; provide base trim at sill and closure plugs.
 - 9. Wall panel finish shall be a dispersion coating based on Kynar 500 FSF PVDF resin that meets the performance criteria of AAMA 2605. The coating shall be applied to the galvalume coated steel by an applicator approved by the formulator and shall contain a minimum of 70 percent by weight of Kynar 500 FSF resin. Dry film thickness, ASTM D1400: 0.20 mil primer coat plus 1.0 mil barrier, 1.0 mil color coat, 2.20 mil total minimum thickness.
 - 10. Certification includes IAS Miami-Dade County Florida product approval.
 - 11. Color: As selected by Owner from manufacturer's full range.
 - 12. Major-Rib Spacing: 12 inches (305 mm) maximum o.c.
 - 13. Panel Coverage: 36 inches (914 mm).
- B. Tapered-Rib, Metal Liner Panels: Formed with raised, trapezoidal major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.

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- 1. Material: AZ50 Galvalume coated steel.
- 2. Thickness: 28 gauge.
- 3. Side laps: Two fully overlapping major ribs secured together with Stainless Steel capped 1/4 inch diameter color-matched carbon steel fasteners.
- 4. Length: Continuous from sill to eave up to 43 feet in length.
- 5. End laps, where required: 4 inches wide, located at a support member.
- 6. Provide full height liner panels (south wall only). Refer to Drawings.
 - a. Wall panel finish shall be a dispersion coating based on Kynar 500 FSF PVDF resin that meets the performance criteria of AAMA 2605. The coating shall be applied to the galvalume coated steel by an applicator approved by the formulator and shall contain a minimum of 70 percent by weight of Kynar 500 FSF resin. Dry film thickness, ASTM D1400: 0.20 mil primer coat plus 1.0 mil barrier, 1.0 mil color coat, 2.20 mil total minimum thickness.
- 7. Color: As selected by Owner from manufacturer's full range.
- 8. Major-Rib Spacing: 12 inches (305 mm) o.c.
- 9. Panel Coverage: 36 inches (914 mm).
- 10. Panel Height: 1.1875 inches.

2.7 METAL SOFFIT PANELS

A. Match Tapered-Rib, Metal Wall Panels.

2.8 THERMAL INSULATION

- A. Faced Metal Building Insulation: ASTM C991, Type II, glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (51-mm-) wide, continuous, vapor-tight edge tabs; with a flamespread index of 25 or less.
- B. Retainer Strips: For securing insulation between supports, 0.025-inch (0.64-mm) nominalthickness, formed, metallic-coated steel or PVC retainer clips colored to match insulation facing.
- C. Vapor-Retarder Facing: ASTM C1136, with permeance not greater than 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E96/E96M, Desiccant Method.
 - 1. Composition: White polypropylene film facing, fiberglass scrim reinforcement, and metallizedpolyester film backing.
- D. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.9 PERSONNEL DOORS AND FRAMES

A. Swinging Personnel Doors and Frames: Metal building system manufacturer's standard doors and frames; prepared and reinforced at strike and at hinges to receive factory- and field-applied hardware according to BHMA A156 Series.

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- Steel Doors: 1-3/4 inches (44.5 mm) thick; fabricated from metallic-coated steel face sheets, 0.036-inch (0.91-mm) nominal uncoated steel thickness, of seamed, hollow-metal construction; with 0.060-inch (1.52-mm) nominal uncoated steel thickness, inverted metalliccoated steel channels welded to face sheets at top and bottom of door.
 - a. Design: Flush panel.
 - b. Core: Polystyrene foam with U-factor rating of at least 0.16 Btu/sq. ft. x h x deg F (0.91 W/sq. m x K).
 - c. Single Door Size: 3 feet by 7 feet.
- 2. Steel Frames: Fabricate 2-inch- (51-mm-) wide face frames from zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.060-inch (1.52-mm) nominal uncoated steel thickness.
 - a. Type: Factory welded.
- 3. Fabricate concealed stiffeners, reinforcement, edge channels, and moldings from either coldor hot-rolled steel sheet.
- 4. Hardware:
 - a. Provide hardware for each door leaf, as follows:
 - 1) Hinges: BHMA A156.1. Three (3) plain bearing, standard-weight, full-mortise, stainless-steel or bronze, template-type hinges; 4-1/2 by 4-1/2 inches (114 by 114 mm), with nonremovable pin.
 - 2) Lockset: BHMA A156.2. Mortise, with lever handle type.
 - 3) Exit Device: BHMA A156.3. Touch- or push-bar type.
 - 4) Threshold: BHMA A156.21. Extruded aluminum.
 - 5) Silencers: Pneumatic rubber; three silencers on strike jambs of single door frames and two silencers on heads of double door frames.
 - 6) Closer: BHMA A156.4. Surface-applied, standard-duty hydraulic type.
 - 7) Weather Stripping: Vinyl applied to head and jambs, with vinyl sweep at sill.
- 5. Anchors and Accessories: Manufacturer's standard units, galvanized according to ASTM A123/A123M.
- 6. Fabrication: Fabricate doors and frames to be rigid; neat in appearance; and free from defects, warp, or buckle. Provide continuous welds on exposed joints; grind, dress, and make welds smooth, flush, and invisible.
- B. Materials:
 - 1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
 - 2. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, CS, Type B; free of scale, pitting, or surface defects; pickled and oiled.

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- 3. Metallic-Coated Steel Sheet: ASTM A653/A653M, CS, Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.
- C. Finishes for Personnel Doors and Frames:
 - 1. Prime Finish: Factory-apply manufacturer's standard primer immediately after cleaning and pretreating.
 - a. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
 - 2. Factory-Applied Paint Finish: Manufacturer's standard, complying with SDI A250.3 for performance and acceptance criteria.
 - a. Color and Gloss: Match building color.

2.10 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
 - 2. Clips: Manufacturer's standard, designed to withstand negative-load requirements.
 - 3. Cleats: Manufacturer's standard, mechanically seamed cleats.
 - 4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
 - 6. Thermal Spacer Blocks (Panels with Insulation Only): Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1-inch (25-mm) standoff; fabricated from extruded polystyrene.

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- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
 - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- D. Flashing and Trim: Aluminum-zinc alloy-coated steel sheet, 0.018-inch (0.46-mm) nominal uncoated steel thickness; finished to match adjacent metal panels.
 - 1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
 - 2. Opening Trim: Aluminum-zinc alloy-coated steel sheet, 0.018-inch (0.46-mm) nominal uncoated steel thickness. Trim head and jamb of door openings, and head, jamb, and sill of other openings.
- E. Gutters: Aluminum-zinc alloy-coated steel sheet, 26 gauge nominal uncoated steel thickness; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2438-mm-) long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
 - 1. Gutter Supports: Fabricated from same material and finish as gutters.
- F. Downspouts: Aluminum-zinc alloy-coated steel sheet, 26 gauge nominal uncoated steel thickness; finished to match metal wall panels. Fabricate in minimum 10-foot- (3-m-) long sections, complete with formed elbows and offsets.
 - 1. Mounting Straps: Fabricated from same material and finish as gutters.
- G. Louvers: Size and design indicated in drawings.
- H. Materials:
 - 1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
 - a. Fasteners for Metal Roof Panels: Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM washer under heads of fasteners bearing on weather side of metal panels.

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- b. Fasteners for Metal Wall Panels: Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless-steel hex washer head, with EPDM sealing washers bearing on weather side of metal panels.
- c. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
- d. Blind Fasteners: High-strength stainless-steel rivets.
- 2. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
- 4. Metal Panel Sealants:
 - a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
 - b. Joint Sealant: ASTM C920; one part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.11 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
 - 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
 - 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
 - 1. Make shop connections by welding or by using high-strength bolts.
 - 2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
 - 3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
 - 4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.

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- 5. Shop Priming: Refer to Section 09 96 00. Shop prime primary framing with specified primer after fabrication.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
 - 1. Make shop connections by welding or by using non-high-strength bolts.
 - 2. Shop Priming: Refer to Section 09 96 00. Shop prime uncoated secondary framing with specified primer after fabrication.
 - 3. G90 Hot-Dip Galvanize Girts
- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written instructions and drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

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- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
 - 1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.
 - a. Joint Type: Snug tightened or pretensioned as required by manufacturer.
- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
 - 1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 - 2. Locate and space wall girts to suit openings such as doors and windows.
 - 3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
- H. Steel Joists: Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders," joist manufacturer's written instructions, and requirements in this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Space, adjust, and align joists accurately in location before permanently fastening.

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- 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
- 4. Joist Installation: Bolt joists to supporting steel framework using carbon-steel bolts unless otherwise indicated.
- 5. Joist Installation: Bolt joists to supporting steel framework using high-strength structural bolts unless otherwise indicated. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.
- 6. Joist Installation: Weld joist seats to supporting steel framework.
- 7. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.
- I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
 - 1. Tighten rod and cable bracing to avoid sag.
 - 2. Locate interior end-bay bracing only where indicated.
- J. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- K. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 METAL PANEL INSTALLATION, GENERAL

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
 - 1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.
- D. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.

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- a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
- 2. Install metal panels perpendicular to structural supports unless otherwise indicated.
- 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
- 4. Locate and space fastenings in uniform vertical and horizontal alignment.
- 5. Locate metal panel splices over structural supports with end laps in alignment.
- 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
- E. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
 - 1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
- F. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
 - 1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.

3.5 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
 - 1. Install ridge caps as metal roof panel work proceeds.
 - 2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with selftapping screws.
- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
 - 1. Install clips to supports with self-drilling or self-tapping fasteners.
 - 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 - 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.

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- 4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
- 5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Predrill panels for fasteners.
- 6. Provide metal closures at peaks and each side of ridge caps.
- C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or selfdrilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.
- D. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
 - 2. Shim or otherwise plumb substrates receiving metal wall panels.
 - 3. When two rows of metal panels are required, lap panels 4 inches (102 mm) minimum.
 - 4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
 - 5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Predrill panels.
 - 6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 - 7. Install screw fasteners in predrilled holes.
 - 8. Install flashing and trim as metal wall panel work proceeds.
 - 9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
 - 10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or selftapping screws.
 - 11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

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- C. Insulated Metal Wall Panels: Install insulated metal wall panels on exterior side of girts. Attach panels to supports at each panel joint using concealed clip and fasteners at maximum 42 inches (1067 mm) o.c., spaced not more than manufacturer's recommendation. Fully engage tongue and groove of adjacent insulated metal wall panels.
 - 1. Install clips to supports with self-tapping fasteners.
 - 2. Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels as weather seal.
- D. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), noncumulative; level, plumb, and on location lines; and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.7 METAL SOFFIT PANEL INSTALLATION

- A. Provide metal soffit panels the full width of soffits. Install panels perpendicular to support framing.
- B. Flash and seal metal soffit panels with weather closures where panels meet walls and at perimeter of all openings.

3.8 THERMAL INSULATION INSTALLATION

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

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- a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
- 4. Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.
 - a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
- 5. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
- C. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.
 - 1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
 - Sound-Absorption Insulation: Where sound-absorption requirement is indicated for metal liner panels, cover insulation with polyethylene film and provide inserts of wire mesh to form acoustical spacer grid.
- D. Board Wall Insulation: Extend board insulation in thickness indicated to cover entire wall. Hold in place by metal wall panels fastened to secondary framing. Comply with manufacturers' written instructions.
 - 1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

3.9 DOOR AND FRAME INSTALLATION

- A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.
- B. Personnel Doors and Frames: Install doors and frames according to NAAMM-HMMA 840. Fit non-fire-rated doors accurately in their respective frames, with the following clearances:
 - 1. Between Doors and Frames at Jambs and Head: 1/8 inch (3 mm).
 - 2. Between Edges of Pairs of Doors: 1/8 inch (3 mm).
 - 3. At Door Sills with Threshold: 3/8 inch (9.5 mm).
 - 4. At Door Sills without Threshold: 3/4 inch (19.1 mm).
 - 5. At fire-rated openings, install frames according to, and doors with clearances specified in, NFPA 80.
- C. Door Hardware:

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- Install surface-mounted items after finishes have been completed at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
- 2. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
- 3. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- 4. Set thresholds for exterior doors in full bed of sealant.

3.10 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - 2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - 3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

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- D. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.
 - 1. Provide elbows at base of downspouts to direct water away from building.
- E. Louvers: Locate and place louver units level, plumb, and at indicated alignment with adjacent work.
 - 1. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
 - 2. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.
 - 3. Protect galvanized- and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of corrosion-resistant paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
 - 4. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required.
- F. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.11 FIELD QUALITY CONTROL

- A. Product will be considered defective if it does not pass tests and inspections.
- B. Prepare test and inspection reports.

3.12 ADJUSTING

- A. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.
- B. Door Hardware: Adjust and check each operating item of door hardware and each door to ensure proper operation and function of every unit. Replace units that cannot be adjusted to operate as intended.
- C. Adjustable Louvers: After completing installation, including work by other trades, lubricate, test, and adjust units to operate easily, free of warp, twist, or distortion as needed to provide fully functioning units.
 - 1. Adjust louver blades to be weathertight when in closed position.

3.13 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

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- C. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
 - 1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- D. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- E. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
 - 1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- F. Doors and Frames: Immediately after installation, sand rusted or damaged areas of prime coat until smooth and apply touchup of compatible air-drying primer.
 - 1. Immediately before final inspection, remove protective wrappings from doors and frames.
- G. Louvers: Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
 - 1. Restore louvers damaged during installation and construction period so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - a. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

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DIVISION 23 HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

SECTION 23 34 23 DIRECT DRIVE UPBLAST CENTRIFUGAL EXHAUST FAN

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: HVAC Power Ventilators
- B. Related Sections:
 - 1. 01 00 00 General Requirements
 - 2. 07 00 00 Thermal and Moisture Protection
 - 3. 09 00 00 Finishes
 - 4. 23 00 00 Heating, Ventilating, and Air-Conditioning (HVAC)
 - 5. 26 00 00 Electrical

1.2 REFERENCES

- A. Air Movement and Control Association Inc. (AMCA):
 - 1. 99 Standards Handbook
 - 2. 200 Publication, Air Systems
 - 3. 201-90 Publication, Fans and Systems
 - 4. 202-88 Publication, Troubleshooting
 - 5. 203-90 Publication, Field Performance Measurement of Fan Systems
 - 6. 211-05 Publication, Certified Ratings Program Product Rating Manual for Fan Air Performance
 - 7. 300-96 Standard Reverberant Room Method for Sound Testing of Fans
 - 8. 311-05 Publication, Certified Ratings Program Product Rating Manual for Fan Sound Performance
 - 9. 99-0401-86 Classification for Spark Resistant Construction
 - 10. 99-2408-69 Operating Limits for Centrifugal Fans
- B. Air Movement and Control Association Inc. (AMCA), American National Standards Institute (ANSI):
 - 1. 204-05 Standards Balance Quality and Vibration Levels for Fans
 - 2. 210-99 Standard Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
- C. American National Standards Institute (ANSI):
 - 1. 11-r1999 Method of Evaluating Load Ratings of Bearings

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- D. American Society of Civil Engineers (ASCE):
 - 1. 7-02 Minimum Design Loads for Building and Other Structures
- E. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):
 - 1. Chapter 45 2003 Handbook, HVAC Applications
 - 2. Chapter 7 2001 Fundamentals handbook, Sound-Vibration
 - 3. Chapter 32 2001 Fundamentals handbook, Duct Design
 - 4. Chapter 18 1992 HVAC System and Equipment handbook, Fans
- F. American Society for Testing and Materials (ASTM):
 - 1. E330-02 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylight and Curtain Walls by Uniform Static Air Pressure Differences
- G. National Fire Protection Association (NFPA):
 - 1. 70 National Electrical Code
 - 2. 90A-02 Standard for the Installation of Air-Conditioning and Ventilating Systems
 - 3. 92A-06 Recommend Practice for Smoke-Control System
 - 4. 92B-05 Standard for Smoke Management System in Malls, Atria, and Large Areas
 - 5. 96-04 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
- H. Occupational Safety and Health Administration (OSHA):
 - 1. 1910.212 General requirements for Machine Guarding
 - 2. 1910.219 General requirements for guarding safe use of mechanical power transmission apparatus
 - 3. 1926.300 General requirements for safe operation and maintenance of hand and power tools
- I. Underwriters Laboratories (UL):
 - 1. 507 Electric Fans
 - 2. 555 Fire Dampers
 - 3. 555S Smoke Dampers
 - 4. 705 Standard Power Ventilators
 - 5. 762 Standard Power Roof Ventilators for Restaurant Exhaust Appliances
 - 6. 793 Snow Load

1.3 SUBMITTALS

A. General: Submit in accordance with Section 01 33 00 Submittal Procedures

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- B. Provide dimensional drawings and product data on each fan
- C. Provide fan curves for each fan at the specified operation point, with the flow, static pressure, and horsepower clearly plotted
- D. Provide outlet velocity and fan's inlet sound power readings for the eight octave bands, decibels, and sones
- E. Strictly adhere to QUALITY ASSURANCE requirements as stated in section 1.04 of this specification
- F. Provide manufacturer's certification that exhaust fans are licensed to bear Air Movement and Control Association (AMCA), Certified Rating Seal for sound and air performance
- G. Installation, Operation, and Maintenance Manual (IOM): Provide manufacturer's installation, operations, and maintenance manual, including instructions on installation, operations, maintenance, pulley adjustment, receiving, handling, storage, safety information and cleaning. A troubleshooting guide, parts list, warranty, and electrical wiring diagrams

1.4 QUALITY ASSURANCE

- A. Performance ratings: Conform to AMCA standard 211 and 311. Fans must be tested in accordance with ANSI/AMCA Standard 210-99 and AMCA Standard 300-96 in an AMCA accredited laboratory. Fans shall be certified to bear the AMCA label for sound and air performance seal
- B. Classification for Spark Resistant Construction, levels A, B and C, conform to AMCA 99
- C. Each fan shall be given a balancing analysis which is applied to wheels at the outside radius. The maximum allowable static and dynamic imbalance is 0.05 ounces (Balance grade of G6.3)
- D. Comply with the National Electrical Manufacturers Association (NEMA), standards for motors and electrical accessories
- E. The High Wind models have been analyzed and stamped by a state license P.E. to the ASCE 7-02 Standard which meets the IBC, Florida and Miami-Dade codes
- F. Each High Wind model is subject to be certified by a third party to the ASTM E330 Static Pressure Difference Standard
- G. All High Wind models have been analyzed using Computational Fluid Dynamics (CFD). The CFD simulates the flow of high speed (150MPH) winds over the surface of objects
- H. The Finite Element Analysis (FEA) is the results from the CFD and it can accurately predict the stress, strain, and deflection resulting from high wind loads

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer, material, products included, and location of installation
- B. Storage: Store materials in a dry area indoor, protected from damage, and in accordance with manufacturer's instructions. For long term storage follow manufacturer's Installation, Operations, and Maintenance Manual

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C. Handling: Handle and lift fans in accordance with the manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage. Follow all safety warnings posted by the manufacturer

1.6 WARRANTY

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents
 - 1. The warranty of this equipment is to be free from defects in material and workmanship for a period of 1 Yr (Standard) from the purchase date. Any units or parts which prove defective during the warranty period will be replaced at the Manufacturers option when returned to Manufacturer, transportation prepaid
 - 2. Motor Warranty is warranted by the motor manufacturer for a period of 1 year. Should motors furnished by us prove defective during this period, they should be returned to the nearest authorized motor service station

1.7 MAINTENANCE

A. Refer to Manufacturer's Installation, Operation and Maintenance Manual (IOM), to find maintenance procedures

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Greenheck, PO Box 410, Schofield, Wisconsin 54476. Phone (715) 359-6171 Fax (715) 355-2399. Website: www.greenheck.com

2.2 DIRECT DRIVE ROOF OR SIDEWALL UPBLAST CENTRIFUGAL EXHAUST FANS -GREENHECK MODEL CUE

- A. General Description:
 - 1. Discharge air directly away from the mounting surface.
 - 2. Upblast fan shall be for roof mounted applications for fan sizes 060-300 or wall mounted applications for fan sizes 060-200.
 - 3. Performance capabilities up to 14,700 cubic feet per minute (cfm) and static pressure to 3 inches of water gauge.
 - 4. Fans are available in twenty-two sizes with nominal wheel diameters ranging from 9 inches through 30 inches (060 300 unit sizes).
 - 5. Maximum continuous operating temperature for fan sizes 098-300 is 400 Fahrenheit (204.4 Celsius) and for fan sizes 060-095 is 160 Fahrenheit (71.1 Celsius)
 - 6. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number
- B. Wheel:

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- 1. Material Type: Aluminum
- 2. Non-overloading, backward inclined centrifugal wheel
- 3. Statically and dynamically balanced in accordance to AMCA Standard 204-05
- 4. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency
- C. Motors:
 - 1. AC Induction Motor
 - a. Motor Enclosure: Open drip proof (ODP) opening in the frame body and or end brackets
 - b. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase
 - c. Mounted on vibration isolators, out of the airstream
 - d. For motor cooling there shall be fresh air drawn into the motor compartment through an area free of discharge contaminants
 - e. Accessible for maintenance
- D. Housing:
 - 1. Constructed of heavy gauge aluminum includes exterior housing, curb cap, windband, and motor compartment housing. Galvanized material is not acceptable
 - 2. Housing shall have a rigid internal support structure
 - 3. Windband to be one piece uniquely spun aluminum construction and maintain original material thickness throughout the housing
 - 4. Windband to include an integral rolled bead for strength
 - 5. Curb cap base to be fully welded to windband to ensure a leak proof construction. Tack welding, bolting, and caulking are not acceptable
 - 6. Curb cap to have integral deep spun inlet venturi and pre-punched mounting holes to ensure correct attachment to curb
 - 7. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators
 - 8. Breather tube shall be 10 square inches in size for fresh air motor cooling, and designed to allow wiring to be run through it
- E. Motor Cover:
 - 1. Constructed of aluminum
- F. Vibration Isolation:
 - 1. Double studded or pedestal style true isolators
 - 2. No metal to metal contact

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- 3. Sized to match the weight of each fan
- G. Disconnect Switches:
 - 1. NEMA rated: NEMA 1: indoor application no water. Factory standard.
 - 2. Positive electrical shut-off
 - 3. Wired from fan motor to junction box installed within motor compartment
- H. Drain Trough:
 - 1. Allows for one-point drainage of water, grease, and other residues
- I. Options/Accessories:
 - 1. Birdscreen:
 - a. Material Type: Galvanized
 - b. Protects fan discharge
 - 2. Roof Curbs:
 - a. Type: GPF Welded, straight side curb with no wood nailer
 - b. Mounted onto wall with fan
 - c. Material: Galvanized
 - d. Insulation thickness: 1 inch
 - e. Flashing Flange: 5 inch

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including technical bulletins, product catalog installation instructions

3.2 EXAMINATION

A. Examine areas to receive fans. Notify the Engineer of conditions that would adversely affect installation or subsequent utilization and maintenance of fans. Do not proceed with installation until unsatisfactory conditions are corrected

3.3 PREPARATION

- A. Ensure roof openings are square, accurately aligned, correctly located, and in tolerance
- B. Ensure duct is plumb, sized correctly, and to proper elevation above roof deck. Install duct as specified in Air Distribution (Division 23)

3.4 INSTALLATION

- A. Install fans system as indicated on the Installation, Operation and Maintenance Manual (IOM) and contract drawings
- B. Install fans in accordance with manufacturer's instructions

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3.5 SYSTEM STARTUP

A. Refer to Installation, Operation, and Maintenance Manual (IOM)

3.6 CLEANING

A. Clean as recommended by manufacturer. Do not use material or methods which may damage finish surface or surrounding construction

3.7 PROTECTION

- A. Protect installed product and finished surfaces from damage during construction
- B. Protect installed exhaust fans to ensure that, except for normal weathering, fans will be without damage or deterioration at time of substantial completion

END OF SECTION 23 34 23

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SECTION 23 81 26 SPLIT-SYSTEM AIR CONDITIONERS

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 split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.3 SUBMITTALS

- A. General: Submit in accordance with Section 01 33 00 Submittal Procedures
- B. Provide dimensional drawings and product data on each fan
- C. Provide fan curves for each fan at the specified operation point, with the flow, static pressure, and horsepower clearly plotted
- D. Provide outlet velocity and fan's inlet sound power readings for the eight octave bands, decibels, and sones
- E. Strictly adhere to QUALITY ASSURANCE requirements as stated in section 1.04 of this specification
- F. Provide manufacturer's certification that exhaust fans are licensed to bear Air Movement and Control Association (AMCA), Certified Rating Seal for sound and air performance
- G. Installation, Operation, and Maintenance Manual (IOM): Provide manufacturer's installation, operations, and maintenance manual, including instructions on installation, operations, maintenance, pulley adjustment, receiving, handling, storage, safety information and cleaning. A troubleshooting guide, parts list, warranty, and electrical wiring diagrams

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: **One** set(s) for each air-handling unit.
 - 2. Gaskets: **One** set(s) for each access door.
 - 3. Fan Belts: **One** set(s) for each air-handling unit fan.

1.5 QUALITY ASSURANCE

- 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. ASHRAE Compliance:

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- 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
- ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 -"Construction and System Start-up."
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

1.6 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchorbolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."
- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period:
 - a. For Compressor: **Five** year(s) from date of Substantial Completion.
 - b. For Parts: Five year(s) from date of Substantial Completion.
 - c. For Labor: **Five** year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 1. Bard Manufacturing, 1914 Randolph Dr, Bryan, OH 43506. Phone (419) 636-1194. Website: <u>www.bardhvac.com</u>
- 2. Company specializing in manufacture of products specified in this section, with minimum of 5 years documented experience. Manufacturer shall have available, complete catalogue data with expanded ratings, installation and maintenance instructions.

2.2 SELF-CONTAINED, WALL MOUNTED AIR CONDITIONER – BARD MODEL W18AB

- A. General Description:
 - 1. Furnish and install self-contained, wall mounted air conditioner, suitable for outdoor use. Unit to be manufactured by Bard Manufacturing Company, Inc in accordance with plans. The unit shall be approved and listed by Intertek ETL Listed (ETL US/C). Unit shall be factory assembled, pre-charged, pre-wired, tested and ready to operate. The manufacturer of equipment shall be ISO 9001: 2015 Certified. Unit performance shall be certified by an independent third party testing agency, in accordance with the Air Conditioning Heating and Refrigeration Institute (AHRI) Standard 390-2003 for Single Package Vertical Units. Unit cooling efficiency shall be specified by EER.

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- B. Cabinet:
 - 1. Construction shall be a single, enclosed, weatherproof casing constructed of 20-gauge galvanized steel, stainless steel, or aluminum (chose one). Unit base is constructed of 16-gauge galvanized steel for painted and aluminum cabinets, stainless steel for stainless cabinets. Each exterior casing panel to be bonderized and finished with baked-on exterior polyester enamel paint prior to assembly. The baked-on cured paint finish shall pass the industry rub test with a minimum of 72 rubs MEK (Methyl Ethyl Ketone) or standard rub test of a minimum of 100 rubs using Toluene. Cooling section shall be fully insulated with a non fiberglass material with heavy duty foil facing for durability and ease of cleaning. Fiberglass F2010 (2019 06) Page 2 of 8 insulation is not acceptable. Openings shall be provided for power connections. Access openings appropriate for outside structure to all fan motors and compressor for making repairs and for removing internal components without removing unit from its permanent installation. Fresh air intake and outdoor coil shall be protected from intrusions by a sturdy metal grating with less than 1/4 inch openings.
 - 2. Colors: Beige
 - Aluminum Stainless Steel Painted cabinet construction shall be a minimum of 20 gauge Zinc coated steel, painted units shall have baked on paint, designed and tested to withstand 1000 hours of salt spray test per ASTM B117-03.
 - 4. Stainless steel construction shall be 316 grade, with stainless steel screws and fasteners for all exposed areas. The condenser fan blade shall be treated with corrosion resistant material, and condenser fan motor mounts shall be stainless steel.
 - 5. Aluminum exterior cabinet shall be ASTM B 2019 grade aluminum with stucco appearance.
- C. Drain Pan:
 - 1. Drain Pan shall be constructed of 20-gauge galvanized steel, bonderized and finished with baked-on exterior polyester enamel paint.
- D. Insulation:
 - 1. Constructed of heavy gauge aluminum includes exterior housing, curb cap, windband, and motor compartment housing. Galvanized material is not acceptable
 - a. Filters: Filters shall be Minimum Efficiency Reporting Value of MERV 8 per ASHRAE standard 52.2. Filters shall be readily available commercial sizes
- E. Mounting Brackets:
 - 1. Full-length side mounting brackets shall be an integral part of the cabinet. Bottom mounting bracket shall be provided.
- F. Refrigeration System:
 - All models shall use a high efficiency hermetic scroll compressor. The compressor shall be covered by a 5-year parts warranty. The refrigeration circuit shall be equipped with factory installed high and low pressure controls, suction and liquid access valves, compressor control module and liquid line filter dryer. A refrigerate metering device is included. Compressor shall

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be mounted on rubber grommets. Unit shall be provided with R-410A (HFC) non-ozone depleting refrigerant.

- G. Outdoor Section:
 - The condenser coil shall be constructed of aluminum plate fins mechanically bonded to seamless copper tubes. The condenser fan, motor and shroud shall be of slide out configuration for easy access. Condenser fan motor shall be enclosed casing with ball bearings. Open winding motors are not accepted.
- H. Indoor Section:
 - The evaporator coil shall constructed of aluminum fins mechanically bonded to seamless copper tubes. Aluminum fins shall have a hydrophilic coatings, to aid in condensate drainage, inhibit mold growth and protect aluminum fins from oxidation. 5 speed indoor blower motor shall be twin wheels with forward curve blades. Motor shall be high efficiency ECM with overload protection.
- I. Electrical Components:
 - Electrical components are easily accessible for routine inspection and maintenance through front service panels. Circuit breaker is standard on all 208/230-volt models and toggle disconnect standard on all 460volt models. Circuit breaker/toggle disconnect access is through lockable access panel.
- J. Control Circuit:
 - 1. The internal control circuit shall consist of a current limiting 24VAC type transformer with resettable circuit. Auto reset high pressure switch and auto reset low pressure switch shall standard, compressor control module with adjustable voltage protection and adjustable delay on make and break shall be standard. To prevent rapid compressor short cycling, a five minute time delay circuit shall be factory installed. A low-pressure bypass shall be factory installed to prevent nuisance tripping during low temperature start-up. F2010 (2019 06) Page 4 of 8 Phase rotation protection and phase failure protection shall be standard factory on all equipment with three-phase power. If unit is wired incorrectly phase monitor will lock out compressor operation and red warning light shall energize. Once power wiring is corrected at field power wiring location, a green light will energize on phase monitor. If a phase of power is lost, the phase monitor will also lock out.
- K. Cooling Options:
 - 1. Standard Cooling: The air conditioner shall function with standard cooling sensible and latent capacities.
 - 2. Balanced Climate: The air conditioner shall function with enhanced latent capacity when BALANCED CLIMATETM cooling mode is enabled. Unit shall includeY1 and Y2 low voltage terminal connections. A 2 stage thermostat shall be capable of operating balanced Climate. Stage 1 cooling will operation with a preprogramed and fully tested reduced fan speed. The reduction in fan speed increases latent capacity and reduces sensible capacity for increased runtime and increased latent capacity. If the 2 stage thermostat call for second stage cooling, the unit shall shift to high speed blower and standard operation. Balanced Climate is

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achieved with a single stage compressor. Expanded rating in balanced climate mode shall be provide at time of submittal, and full factory performance data shall be available upon request.

- L. Heating Options:
 - 1. None
- M. Ventilation Options:
 - 1. WA/WL models are designed to provide optional ventilation packages to meet all of your ventilation and indoor air quality requirements. All F2010 (2019 06) Page 5 of 8 ventilation packages are factory or field installed, and easily removable for service. Units shall include an independent ventilation low voltage terminal connection, allowing for a independent 24v signal provided by controls to operate the ventilation package. No additional field installed relays shall be required to provide independent ventilation. Ventilation shall be deenergized during unoccupied hours unless otherwise specified. Only one ventilation package shall be provide and must be specified.
 - a. Barometric Fresh Air Damper (X) Damper provided with multiple pin positions, each pin position shall allow damper to open to that pin, whenever the supply blower is energized. The will fall shut when supply fan is deenergized. Damper shall be shipped in closed position. No exhaust path is provided in the unit. If no ventilation package is specified, this option shall be provided.
 - 2. Economizer
 - a. The Economizer is internally mounted and allows outside air to be used for free-cooling when temperature and humidity conditions are favorable. The amount of exhaust air varies in response to the system controls and settings defined by the user. It includes a built in exhaust air damper. The economizer is designed to provide free cooling when outside conditions are cool and dry enough to satisfy cooling requirements without operating the compressor, providing lower operating costs while extending the life of the compressor.
 - b. Standard Features: 4cfm/ft2 or less damper leakage rate at 1"w.c. pressurization Fully modulating Honeywell hi-torque 44 lb.-in. actuator Simple single blade design Positive shut-off with non-stick gaskets Electronic DB and Enthalpy sensors Honeywell JADE electronic economizer module with precision settings and diagnostics
- N. Filter Options:
 - 1. 2" Pleated MERV 8
- O. Unit Control Options:
 - 1. Low Ambient Control
 - 2. Outdoor air thermostat (used as compressor cut-off)
 - 3. Filter Pressure switch

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- P. Installation:
 - 1. Installation shall be done in strict adherence to Bard's Installation Instructions.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.
- D. Equipment Mounting:
 - 1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
 - 2. Install ground-mounted, compressor-condenser components on polyethylene mounting base.
 - 3. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 4. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
 - 1. Water Coil Connections: Comply with requirements specified in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties." Connect hydronic piping to supply and return coil connections with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.
 - Remote, Water-Cooled Condenser Connections: Comply with requirements specified in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties." Connect hydronic piping to supply and return connections with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.
- C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply ducts to split-system air-
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conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.4 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

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

END OF SECTION 23 81 26

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DIVISION 26 ELECTRICAL

SECTION 26 05 00 COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 CONSTRUCTION DRAWINGS

- A. The contract drawings indicate the extent and the general conditions of the work. If any departures from the contract drawings are deemed necessary by the electrical sub-contractor (herein referred to as the sub-contractor or contractor), details for such departures and the reasons therefore shall be submitted to the Engineer immediately.
- B. These items shall be submitted, in writing, for approval. No such departure shall be made without prior written approval of the Engineer.
- C. The drawings are diagrammatic and indicate the general arrangement of fixtures, equipment and work included in the contract.
- D. The sub-contractor shall follow the drawings in laying out work and check the drawings of other trades to verify spaces in which work will be installed. Maintain head room and space conditions at all points.
- E. Likewise, the sub-contractor shall follow the drawings in laying out work and coordinate with the drawings of other trades to verify locations for all equipment on site. Maintain proper clearances from new or existing utilities or structures. The sub-contractor is responsible for coordinating any requirements of local utilities.
- F. If directed by the Engineer, the sub-contractor shall, without extra charge, make reasonable modifications (as judged by Engineer) in the layout and installation of the electrical equipment, fixtures, and devices as needed to prevent conflict with work of other trades (whether on site or within structure); to prevent conflict with new or existing utilities (whether on site or within structure); or for proper execution of the work.

1.2 ORDINANCES AND REGULATIONS

A. If the work as laid out, indicated, or specified is contrary to, or conflicts with codes ordinances or regulations, the sub-contractor shall report same to Engineer before submitting his bid. Engineer will issue instructions as to procedure.

1.3 PERMITS AND FEES

A. The Contractor shall insure that the necessary permits and inspections required for his work are obtained. He shall deliver to Engineer certificates of inspection issued by authorities having jurisdiction.

1.4 GUARANTEE AND SERVICE

A. In addition to guarantee of equipment by manufacturer of each piece of equipment specified herein, each sub-contractor shall also guarantee such equipment and make good any defect of material or workmanship occurring during a period of (1) year from final acceptance test, without expense to Owner.

B. Each Subcontractor shall service systems for (1) year from final acceptance. Such service will include lubrication, necessary adjustment, and/or replacement of defective equipment and materials furnished. Incandescent light bulb (incandescent only) replacement guarantee shall be limited to 30 days, H.I.D. and fluorescent lamps at 180 days after final acceptance.

1.5 CODES AND INSPECTIONS

- A. Work shall comply with:
 - 1. National Electric Code (2017 edition)
 - 2. O.S.H.A. Standards
 - 3. State of Florida ADA Handicap Requirements
 - 4. 2020 State of Florida Building Code.
 - 5. Other Standards so adopted by the Florida Building Code.

1.6 SCOPE

A. Furnish labor, materials, and equipment necessary for a complete and workable system and installation.

1.7 STORAGE OF MATERIALS

A. Prior to and during installation, store materials to protect them from injury or deterioration. Material shall not be stored in contact with ground or floor. If suitable storage areas are not available at job site, provide temporary construction or store material off-site in suitable warehouses. Do not remove manufacturer's packing materials until ready to install.

1.8 ELECTRICAL SERVICE

A. Electrical service and feeders shall be as indicated. Consultation and coordination with applicable Utility Company representative is a sub-contractor job requirement prior to start of project. Coordination shall occur within 7-days of sub-contract award. Advise the Engineer immediately of any changes which will cause an increase of cost to the Owner or other change of scope; without notification within 7 days, no cost increases will be accepted.

1.9 CONTINUITY OF SERVICE

- A. Uninterrupted use of existing facility must be continued during the entire time required for the installation of equipment and work required under this contract. This shall be applicable to all electrical systems involved in this contract and shall include: power, lighting, telecommunications, television, etc.
- B. Contractor shall perform all work so as to maintain the lowest possible amount of "down time." Connections to existing services or equipment, change of service, or any other work that will require periods of "down time," shall be scheduled and performed after hours so as to prevent "down time."
- C. If after-hour work is not acceptable to client/owner, contractor may opt to schedule "down time" with the owner. This "down time" shall be schedule a minimum of 48 hours in advance of the proposed interruption.

1.10 REMOVAL OF EXISTING CIRCUITRY

- A. Where existing devices are to be removed during construction (or demolition), all fixtures, conduits, boxes, and wiring (not required to maintain continuity of service) shall be completely removed.
- B. Any removed equipment of value shall be given to the owner for storage. Contractor shall otherwise be responsible for disposal of demolished equipment and materials.

1.11 EXISTING BUILDING EQUIPMENT

A. Contractor shall disconnect and remove all existing equipment within an area of renovation, unless specifically required to remain or to maintain continuity of service.

1.12 COORDINATION

- A. It shall be the responsibility of the electrical contractor to coordinate the installation details of <u>all</u> electrically operated equipment and devices. This shall include all light fixtures and other devices within structures, on exterior of structures, or on site.
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways and wireways will be clear of obstructions and of the working and access space of other equipment.
- B. The electrical contractor shall periodically inspect the installations of other trades and notify the General Contractor and Engineer of any conflicts with electrical systems.
- C. Any courses of action taken to accommodate conflicts after-the-fact shall not be considered as "extra services" and will not be subject to additional billings as such.
- D. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

1.13 ACTION SUBMITTALS

- A. Section 01 33 00 Submittal Procedures Requirements for submittals.
- B. All submittals of electrical materials or equipment shall be made at the same time contained within one binder and one letter of transmittal.
- C. Provide shop drawings in hard copy (book) format for the following:
 - 1. Light fixtures and lamps
 - 2. Switchgear and panelboards / loadcenters
 - 3. Electrical devices (switches, receptacles, cover plates)
 - 4. Any and all Electronics including TVSS (Surge Protection devices)

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- 5. Wire & cable
- 6. Conduit & fittings
- 7. All associated systems equipment
- 8. All devices
- D. Corrections or comments made on shop drawings during review do not relieve contractor from compliance with requirements of drawings and specifications. This check is only for review of general conformance with design concept of project, and general compliance with information given in contract documents.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials and equipment are specified herein by a single or by multiple manufacturers, to indicate quality, material, and type of construction desired. One Manufacturer's product is indicated and has been used as basis for design; it shall be each Subcontractor's responsibility to ascertain that alternate Manufacturer's products conform to detailed specification, and that size and arrangement of equipment is suitable for installation. Products of other Manufacturer's will be considered for use if in the Engineer's opinion, item requested for substitution is equal to that specified. Should a Subcontractor desire to make a substitution, he should apply in writing, stating amount of credit or extra involved, including complete Engineering data.
- B. It shall be the responsibility of each sub-contractor making a substitution to include costs for changes required by other trades for proper operation of equipment proposed to be substituted.
- C. Before purchase of equipment, submit shop drawings for approval. Submit as complete as possible. Identify each item submitted. Information on shop drawings shall contain all that is necessary to show that equipment complies with specifications and drawings. Show required modifications. One complete set of approved shop drawings shall be kept at job site.
- D. The sub-contractor is responsible for providing all incidental materials needed for a complete and working installation. This is in addition to the specific equipment specified in the contract documents.
- E. All materials and equipment furnished under this contract shall bear the label of approval of the Underwriters Laboratory, Inc. (UL).

2.2 INSTRUCTIONS

A. Each sub-contractor shall furnish (3) complete sets of operations and maintenance instructions applying to each piece of equipment installed in conjunction with this contract.

PART 3 - EXECUTION

3.1 SUPERVISION

- A. Maintain competent Superintendent in charge of work. Superintendent shall be qualified and have suitable experience in type of work involved.
- B. Should he be deemed not capable by the Engineer or Owner, he shall be replaced immediately

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by a Superintendent who is satisfactory. After a satisfactory Superintendent has been assigned, he shall not be withdrawn without consent of Engineer.

3.2 WORKMANSHIP

- A. Materials and equipment shall be installed in a neat and industry standard manner as judged by the Engineer.
- B. The Engineer reserves right to direct removal and replacement of items which, in his opinion, do not present an orderly and reasonably neat appearance provided such as orderly installation can be made using customary trade methods. The removal and replacement shall be done when directed in writing by the Engineer at sub-contractor's expense and without additional expense to Owner.

3.3 CONNECTING TO WORK OF OTHERS

- A. Before starting his work and from time to time as work progresses, the Electrical sub-contractor's superintendent shall examine work and materials installed by others insofar as they apply to his own work, and shall notify the Engineer immediately in writing of conditions which will prevent satisfactory results from the installation of the system.
- B. Should the Electrical subcontractor start his work without proper notification, it shall be construed as an acceptance by him of all conditions and as to suitability of the work of others to receive his work.

3.4 DAMAGE TO OTHER WORK AND PERSONNEL

- A. The sub-contractor shall be responsible for proper protective measures when working overhead or in finished areas. He shall repair, replace, or touch up finished surface which may be damaged as a result of his work or operations. This is to include preparation, priming, and refinish of structure due to welding or machining for attachment of electrical equipment.
- B. Sub-contractor shall carry suitable insurance as prescribed by law for protection of his employees, other persons, materials and equipment on site.

3.5 CUTTING, PATCHING, AND EXCAVATIONS

- A. Cutting and patching of walls, partitions, floors, concrete, pits and chases in wood and masonry will be done by this sub-contractor as indicated or as directed by Engineer. Cutting of steel, wood, or other main structural parts must be approved by Engineer prior to commencing cutting.
- B. Sub-contractor shall do necessary excavation and back-filling for his own work.

3.6 REMOVAL OF RUBBISH

A. Subcontractor shall maintain premises free from accumulations of waste material or rubbish caused by his employees or work. At completion of work he shall remove tools, scaffolding, materials and rubbish from building site, and leave premises and his work in a clean, orderly, and acceptable condition.

3.7 CLEANING AND ADJUSTMENTS

A. Upon completion of work, each sub-contractor shall clean, oil, and grease fans, motors, and other running equipment and apparatus which he installs, and shall make certain such apparatus and

mechanisms are in proper working order and ready for test.

3.8 ACCEPTANCE INSPECTION

- A. Contractor shall read applicable sections of these specifications, and prepare and assemble required test reports, maintenance manuals, certificates, guarantees and letters of instruction. Contractor's representatives responsible for work under Division 16 shall be present at time of acceptance inspections, and shall furnish required mechanics, tools, and ladders to assist in inspection.
- B. Prior to requesting final inspection, the sub-contractor shall clean, and where required, paint electrical equipment installed. Exposed conduits, exposed outlet boxes, surface panel cabinets, etc. shall be finished to match walls or ceilings. Cabinets, panels, panel covers, scratched or otherwise damaged shall be painted with factory supplied color-matched paint. Interiors of panelboards, switchboards and cabinets shall be vacuumed, free of dust and debris.
- C. List of items to be corrected as a result of acceptance inspection will be furnished to the Engineer for transmittal to the Contractor.
- D. Notify the Engineer in writing of items appearing on list for correction which are disputed by the sub-contractor. When ready, request in writing a re-inspection of work. Should items on the rejection list remain uncorrected, additional inspections required to ascertain completion shall be paid by Contractor to the Engineer at current billing rates of the Engineer.

3.9 EQUIPMENT CONNECTIONS

- A. Provide electrical power and control systems to indicated equipment. Included are wiring, raceways, disconnects, and other devices. Motor starters for mechanical equipment, if not an integral part of the equipment, are the direct responsibility of the electrical sub-contractor to provide, install, and connect as directed by the mechanical sub-contractor. Starter heater sizes, etc. shall be coordinated with the actual equipment installed. Circuit breaker combination type NEMA 1 starters with 120 volt control shall normally be the requirement. Control wiring shown on mechanical drawings shall be provided under this section by the mechanical Contractor if it is a low voltage controls system, however all cabling shall meet the requirements of this division. The electrical Contractor shall coordinate all details of the control wiring for any conduit requirements. Maintain (1) set of approved equipment shop drawings and control system wiring diagrams on the job. Provide rough-in power and control in accordance with this set.
- B. Rough-in locations, type of connection (straight blade or twist-lock receptacle, wall junction box with flex conduit to unit, or unit mounted J-box etc.), ampacity of the connections, single or 3-phase circuits required are the responsibility of Electrical Contractor. This applies to such equipment as: water coolers, water heaters, pumps, vent and exhaust fans, and other equipment. Final information must be obtained from the actual "to be installed" equipment drawings; do not order branch circuit breakers until the equipment shop drawings have been reviewed.

END OF SECTION 26 05 00

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SECTION 26 05 01 TEMPORARY POWER & LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. This section contains specifications and requirements for the installation of equipment and devices to be used for temporary construction power.

1.2 SCOPE

- A. The Electrical Contractor shall be responsible for the permitting, provision, and installation of temporary construction power equipment and the maintenance of temporary power.
- B. Arrangements shall be made with the Utility Company for source location for power to be used by all trades during the period of construction.
- C. The location of the service and distribution point for temporary power shall be designated by the Contractor.
- D. Power costs during construction and testing shall be paid by the Contractor.

1.3 SERVICE CAPACITY

A. Minimum size of electrical temporary service shall be 200 amps at 120/240 volt, single phase.

1.4 DISTRIBUTION

A. A single point of distribution shall be provided with each trade power user responsible for site distribution for their own needs with the exception of lighting. Current O.S.H.A., A.D.A., and N.E.C. code rules shall govern installation and equipment.

1.5 TEMPORARY LIGHTING

A. Lighting will be required in all spaces at a minimum level of 30 foot candles measured at floor level. At a minimum, there shall be one lamp per space at all times. Electrical Contractor shall be responsible for maintenance of temporary lighting.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All equipment supplied for use as temporary power and lighting shall be UL listed.
- B. All 15 and 20 Amp, 120 Volt receptacles for use as temporary power shall be protected from ground fault.

PART 3 - EXECUTION – Not Used

END OF SECTION 26 05 01

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

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes specifications for the following:
- B. Building wires and conductors rated 600 Volts and less.
- C. Connectors, splices, and terminations rated 600 Volts and less.

1.2 QUALITY ASSURANCE

A. All cables and conductors shall be listed for the environments in which they are to be installed.

1.3 ACTION SUBMITTALS

- A. Section 01 33 00 Submittal Procedures Requirements for submittals.
- B. Product Data: For each type of product indicated.
- C. Qualification Data: For testing agency.
- D. Field quality control test reports.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Conductors shall be copper (unless noted otherwise on plans). Conductor insulation type shall THHN/THWN or XHHW. All conductor ampacities are to be based upon 75 degree C (Centigrade) insulation. No down-sizing is permitted of conductor size based upon use of 90 degree C rated insulation.
- B. Conductors sizes number 10 and smaller are to be solid Copper. Larger sizes are permitted to be stranded.

2.2 MANUFACTURERS

- A. Connectors and Splices: Subject to compliance with requirements, provide products by:
 - 1. Ideal Industries

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- 2. 3M, Electrical Products Division
- 3. Hubbell
- 4. Pass and Seymour
- B. Conductors: Subject to compliance with requirements, provide products by:
 - 1. American Insulated Wire Corp.
 - 2. General Cable Corporation
 - 3. Southwire Company

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Branch circuit outlets shall be connected as indicated.
- B. The continuity of neutrals of branch circuits shall not be made on the terminals of any device. Instead, the neutral shall be spliced and tap connected to device. This will assure no opening of neutral in replacement of device.
- C. Fixture and branch circuit wiring joints for conductors No. 6 AWG and smaller in junction and outlet boxes shall be made with U.L. approved pressure type connectors. Use Ideal Industries Models 451, 452, or 454 and Scotch-Lock types Y, R, or B. Splices and taps for conductors No. 4 AWG and larger shall be made using 2 bolt type solder-less connectors made of high conductivity bronze castings, taped with at least 3 layers of insulating tape, half-lapped. No spring or wedge type "push-in" connections are permitted.
- D. All fixture terminations shall be made by means of clamp type connectors using screws or bolts to apply pressure. No spring or wedge type "push-in" connections are permitted. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- E. See section "IDENTIFICATION FOR ELECTRICAL SYSTEMS" for coloring and marking of cabling.
- F. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway. 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.

END OF SECTION 26 05 19

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SECTION 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section contains specifications for grounding and bonding equipment.

1.2 GENERAL

A. Provide grounding and bonding systems in strict accordance with applicable edition of N.E.C. Art. 250.

1.3 ACTION SUBMITTALS

- A. Section 01 33 00 Submittal Procedures Requirements for submittals.
- B. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All bonding and grounding shall be with copper conductors where wire type conductors are utilized.
- B. Outlet box to device shall be by use of self-grounding devices or a separate "pigtail" to the raceway/box grounded system.
- C. Ground rod electrodes to be a minimum of ten feet in length, Copper-clad steel, 3/4" in diameter, sectional type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Service entrance ground shall consist of a set of electrodes as described and specified in NFPA 70. Art. 250.50 (a) (b) & (c) and in the plan set. The primary grounding electrode is to be 20 feet of number 4 (1/2") reinforcing steel in the building footer or foundation with the end turned up above slab for approved clamp connection. "Made" electrodes described in NFPA 70 250.52 shall be used in addition to the above where conditions permit. If it is not possible to connect to steel within the building footer or foundation, the contractor shall provide at least one concrete encased "Made" electrode. Interconnect conduits entering and leaving service entrance equipment using grounding bushing and copper wire of the ampacity required by Art. #250. Provide connection to service entrance ground. All electrodes shall be bonded together as required by Art. #250.

- B. All equipment which receives power from the electrical service shall be connected to the premises grounding system with a conductor sized from NFPA 70, Table 250.122.
- C. All metal interior piping and ductwork shall be bonded to the electrical service equipment enclosure with a conductor sized by 250.66.
- D. The size of the service grounding electrode conductor shall be in accord with 250.66.
- E. All telecommunications and signaling equipment to be bonded to the electrical service equipment with a #6 Copper conductor.
- F. Terminate bond conductor at 1/4" x 2" x 12" grounding bus at each service and central equipment location.
- G. Terminate bond conductor on appropriate cabinet terminal at each terminal cabinet.

3.2 INSPECTION AND TESTING

- A. Upon completion of electrical installation, contractor shall visually inspect all grounding and bonding connections for security.
- B. Subsequent to visual inspection, the contractor shall test the resistance to ground of the grounding electrodes.
- C. Testing shall be performed when soil is dry and 48 or more hours have passed since any precipitation has occurred.
- D. Testing shall use fall-of-potential test method according to IEEE 81.
- E. Resistance shall not exceed 20 Ohms to ground between earth and electrodes. If resistance is greater than 20 Ohms, contractor shall install additional grounding electrodes until resistance is 20 Ohms or less.
- F. Prepare report of all test results and any corrective measures that were applied. Report shall include dimensional drawings of all test locations, ground rods, electrodes, etc.
- G. If resistance to ground is found to be excessive, notify Engineer promptly and include recommendations for reduction.

END OF SECTION 26 05 26

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SECTION 26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes specifications and requirements for:
- B. Hangers and supports for electrical equipment and systems.
- C. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 ACTION SUBMITTALS

- A. Section 01 33 00 Submittal Procedures Requirements for submittals.
- B. Product Data: For all support systems.

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Supporting devices shall be of materials having corrosion protection at least equal to the raceway.
- B. For environments exposed to salt such as coastal environments, supports and fasteners shall be stainless steel.

2.2 MANUFACTURERS

- A. Steel Slotted Support Systems: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
 - 1. Allied Tube & Conduit
 - 2. Cooper B-Line, Inc.
 - 3. Thomas & Betts Corporation

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- 4. Unistrut; Tyco International, Ltd.
- B. Raceway Supports: As described in NECA 1 and NECA 101.
- C. Conduit Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway to be supported.
- D. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Hilti Inc.
 - 3) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A325.
 - 5. Toggle Bolts: All-steel springhead type.
 - 6. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Support raceways securely with conduit straps, wall brackets, conduit hangers or ceiling trapeze. Fastenings shall be by sheet metal screws or screw type nails to wood, by toggle bolts to concrete block, expansion bolts on concrete or brick and beam clamp on steel or bar joists. Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

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- C. Support shall be provided as close as practical to, but not exceeding 18 inches from an unsupported box or from change of direction. In horizontal runs this support may be omitted if box is independently supported and box connection is not made with chase nipple or threadless box connector. In vertical runs, load produced by weight of raceway and conductors shall not be carried by raceway terminal but must be carried entirely by conduit supports.
- D. All supports shall be located according to N.E.C. Article 300.
- E. Conduits shall not be installed on structural members where the conduits will be subject to continuous exposure to water due to the orientation of the structural member.

3.2 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

3.3 PAINTING

- A. Touchup: Comply with requirements in Division 09 Painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION 26 05 29

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SECTION 26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes specifications and requirements for electrical raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 GENERAL

- A. Raceway locations shown are diagrammatic. Runs are to be governed by structural conditions. Install raceways concealed unless specifically noted. Cap conduits immediately after installation to prevent entrance of foreign matter. Run concealed raceways with minimum bends in shortest practical distance. Bends and off- sets shall be of code radius. 360 degrees total accumulation of bends in a single run is the maximum allowed. Run exposed conduit parallel and perpendicular to surface or exposed structural members. Follow surface contours as much as practical to provide a neat appearance.
- B. These specifications apply to all conduits for all systems on the project, including telephone, CCTV, security, etc.

1.3 ACTION SUBMITTALS

- A. Section 01 33 00 Submittal Procedures Requirements for submittals.
- B. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- C. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Custom enclosures and cabinets.
 - 2. For handholes and boxes for underground wiring, including the following:
 - a. Duct entry provisions, including locations and duct sizes.
 - b. Frame and cover design.
 - c. Grounding details.
 - d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
 - e. Joint details.
- D. Source quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories are to be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Conduits shall be by one of the following:
 - 1. Pittsburgh Standard
 - 2. Youngstown
 - 3. Republic
 - 4. Wheatland
 - 5. Allied Tube
 - 6. Carlon
- B. Boxes shall be by one of the following:
 - 1. Thomas & Betts (T&B)
 - 2. RACO
 - 3. Carlon
 - 4. O-Z
- C. Fittings shall be by one of the following:
 - 1. T&B
 - 2. Hubbell
 - 3. Allied Tube
 - 4. Caddy
 - 5. RACO
 - 6. Carlon
 - 7. O-Z
- D. Other manufacturers may be used subject to prior approval.

2.2 CONDUIT

- A. FMC
 - 1. Flexible Metal Conuit (FMC) shall be of Zinc coated steel construction. Aluminum is not permitted.
 - 2. All FMC box connectors shall be insulated throat type.
 - 3. 3/8" aluminum Greenfield for fixture "pigtails" and 1/2" aluminum Greenfield for small motor (1 horse power or less) connections are acceptable.
- B. LFMC

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- 1. Liquidtight Flexible Metal Conduit (LFMC) shall be of steel construction. Aluminum is not permitted.
- 2. All LFMC box connectors shall be insulated throat type.
- C. LFNC
 - 1. Liquidtight Flexible Nonmetallic Conduit (LFNC) shall be Type B of PVC construction.
 - 2. Conduit shall have smooth interior walls.
 - 3. All LFNC box connectors shall be insulated throat type.
- D. RMC
 - 1. Rigid Metallic Conduit (RMC) shall be of hot-dipped galvanized construction. Aluminum is not permitted.
 - 2. All RMC box connectors to be threaded with insulated throats.
 - 3. All threaded fittings are to have joint compound applied prior to installation. Compound to be listed for use in electrical installations to lubricate and protect joint from corrosion and enhance electrical conductivity.
- E. RNC
 - 1. Rigid Nonmetallic Conduit (RNC) shall be Schedule 40 or 80 PVC, NEMA TC 2.
 - 2. Fittings are to be NEMA TC 3 and shall match conduit type and material.

2.3 JUNCTION BOXES

- A. Provide junction boxes in quantities, locations, and sizes as required by installation or code.
- B. All interior boxes shall be of galvanized steel construction. Provide cover plates of same construction as box.

2.4 ELECTRICAL BOXES AND FITTINGS

A. Outlet boxes shall be one-piece or projection welded galvanized stamped steel for ganged sizes required. Sectional boxes are not be acceptable. Where necessary, boxes larger than standard shall be provided in accordance with the National Electrical Code to prevent crowding of conductors. Outlet boxes required for communications systems and mechanical control devices shall be installed under this section. Verify outlet box size required for systems other than electrical power from shop and manufacturer's drawings. Install outlets in accordance with those requirements.

2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. Comply with SCTE 77.
 - 1. Color of Frame and Cover: Gray.
 - 2. Units shall be designed for flush burial and have integral closed bottom, unless otherwise indicated.

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- 3. Cover to be weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- 4. Cover finish to be nonskid finish shall have a minimum coefficient of friction of 0.50.
- 5. Cover legend to be molded lettering, as indicated for each service.
- 6. Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
- 7. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover to be molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.
 - 1. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. CDR Systems Corporation.

2.6 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by an independent testing agency.
 - Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 3. Testing machine pressure gauges shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 MATERIALS APPLICATION

- A. Outdoors
 - 1. Exposed above ground: RMC
 - 2. Underground: RNC, Schedule 40
 - 3. Boxes and enclosures: NEMA 4.
 - 4. Underground mounted hand holes and boxes, not subject to vehicular traffic and loading: Polymer concrete, SCTE 77, Tier 15 structural load rating.
- B. Indoors

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- 1. Exposed above floor: RMC
- 2. Exposed above floor, subject to damage: RMC
- 3. Under or within floor slab-on-grade: RNC, schedule 40

3.2 INSTALLATION

- A. Exposed conduits in damp or wet locations and where exposed to weather shall be installed with off-set brackets or supports to maintain a clearance of at least 1" to finished surface.
- B. Where rigid conduit is installed into a cabinet, box or gutter, use insulating throat bushing T&B series 222, 0-Z type A or RACO series 1402. Use two T&B series 141 lock-nuts to secure conduit to enclosure. Grounding bushing shall be 0-Z type BL. Expansion/deflection fittings shall be 0-Z type DX.
- C. Connect motors and equipment subject to vibration with flexible conduits. In interior dry locations, FMC shall be used. In interior locations subject to minor amounts of moisture, LFMC shall be used. In exterior and interior wet locations, LFNC-B shall be used. All flexible conduits shall have separate bond wire except fixture tails. Any flexible connections located in listed/classified locations shall be in accordance with the wiring methods for that location.
- D. Boxes for wall and ceiling outlets shall finish flush and straight at edge of finished surface. Wall outlets in exposed concrete block, masonry and tile walls shall be installed with extra-deep square corner boxes or with standard boxes and square cornered tile wall covers, so that conduit off-sets are not required. Outlet boxes for light fixture mounting shall be equipped with fixture studs. No outlets shall be installed back-to-back in any wall.
- E. All conduit and box installation is to be completed prior to any conductor installation.
- F. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

3.3 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support handholes and boxes on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.4 INSPECTION

- A. Contractor shall verify all conduit fittings such that there is no play in the connection.
- B. Repair any damage to any paint, enamel, or galvanizing coatings with manufacturer recommended touchup coating.

END OF SECTION 26 05 33

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SECTION 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes identification requirements for raceways, power and control cabling, conductors, equipment, and other electrical systems.

1.2 GENERAL

- A. Coordinate all identification and labeling with other trades for proper equipment names.
- B. Coordinate all identification and labeling with requirements of other Sections requiring identification, Drawings, Shop Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual with requirements of local Codes and applicable Standards.

1.3 ACTION SUBMITTALS

- A. Section 01 33 00 Submittal Procedures Requirements for submittals.
- B. Product Data: For each electrical identification product indicated.
- C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70, ANSI 13.1, and ANSI C2.

PART 2 - PRODUCTS

2.1 RACEWAYS

- A. Labeling shall be black letters on orange background and indicate voltage and system type.
- B. Self-adhesive labeling shall be preprinted by machine. Material shall be permanently flexible and laminated with a clear, all-weather, chemical & UV resistant film. Edges shall be taped with matching tape to protect label edges.
- C. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

2.2 POWER & CONTROL CABLING

A. Self-adhesive labeling shall be preprinted by machine. Material shall be permanently flexible and laminated with a clear, all-weather, chemical & UV resistant film. Edges shall be taped with matching tape to protect label edges.

2.3 CONDUCTORS

- A. Color coding tape shall be 3 mil, self adhesive, 1 to 2 inch wide.
- B. Self-adhesive labeling shall be preprinted by machine. Material shall be permanently flexible and laminated with a clear, all-weather, chemical & UV resistant film. Edges shall be taped with matching tape to protect label edges.

C. Marking tape shall be self adhesive vinyl wrap-around type with machine printed text.

2.4 EQUIPMENT

- A. Engraved, laminated acrylic or melamine label prepunched or drilled for riveting to equipment. White letters on a dark-gray background with minimum letter height shall be 3/8 inch.
- B. Panel schedules shall be machine printed with each circuit clearly identified.

2.5 SIGNAGE

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes. Signs shall be engraved with black letters on white face, prepunched or drilled for mechanical fasteners.

2.6 WARNING LABELS AND SIGNAGE

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-adhesive warning labels are to be factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Signage is to have a nominal size of 7 by 10 inches.
- D. Warning labels and signage shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER ELECTRICAL SHOCK HAZARD EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING OSHA REGULATION AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.7 WARNING TAPE

- A. Tape:
 - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to destructive substances commonly found in soils.
 - 4. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum foil core, and a clear protective film to allow inspection of the continuity of the conductive core, bright- colored, continuous-printed on one side with the inscription of the utility, compounded for direct burial service.
 - 5. Overall Thickness: 8 mils.
 - 6. Foil Core Thickness: 0.35 mil.
 - 7. Weight: 34 lb/1000 sq. ft.
 - 8. 3-Inch Tensile According to ASTM D 882: 300 lbf, and 12,500 psi.

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- B. Color and Printing:
 - 1. Comply with ANSI Z535.1 through ANSI Z535.5.
 - 2. Power marking tape to be red colored and shall marked with "ELECTRIC LINE, HIGH VOLTAGE".
 - Communications marking tape to be orange colored and marked with one of the following (depending on system installed): "TELEPHONE CABLE", "CATV CABLE", "COMMUNICATIONS CABLE", "OPTICAL FIBER CABLE".

PART 3 - EXECUTION

3.1 GENERAL

- A. Conduits & Raceways shall be marked and labeled as follows:
 - 1. Contractor shall label all boxes containing power cabling with the panel and circuit of origin of each conductor within the box. Marking shall be made with permanent black marker and stencil with 1/4" lettering.
- B. Cabling shall be marked and labeled as follows:
 - 1. All power cabling shall be identified where it is accessible and in boxes, troughs, panels, etc. as follows:
 - a. An identification label shall list panel and circuit of origin and shall be affixed to each individual cable.
- C. Conductors shall be marked and labeled as follows:
 - 1. Power conductors shall have adhesive type wrap labels applied indicating panel and circuit of origin. Labels shall be affixed at every location where cable can be accessed.
 - 2. Power conductors shall be identified by color as follows:
 - a. Color coding of cabling on 120/240 Volt, Single Phase systems shall be
 - 1) Line 1 Black
 - 2) Line 2 Red
 - 3) Neutral White
 - 4) Ground/Bond Green
 - 5) Switch Black/Red (Opposite of Line conductor)
- **3.2** Wiring of size #6 and smaller shall have factory colored insulation as listed above. Larger sizes may be marked by tape.
 - A. Equipment shall be marked as follows:
 - 1. All equipment listed as NEMA 1, or located inside of building or structure (so long as location is not classified), shall have identification label riveted to enclosure.

- 2. All equipment listed other than NEMA 1, shall have stencil type label painted onto enclosure. Lettering shall be 1 inch tall (minimum) and of contrasting color to equipment enclosure.
- 3. contractor shall paint on floor boundaries of dedicated equipment space. Paint shall be a high-traffic, non-slip, epoxy type, yellow in color. Boundary stripes shall be 2 inches in width. The words "DEDICATED EQUIPMENT SPACE NO STORAGE PERMITTED" shall be painted into boundary with same paint. Lettering shall be 2 inches in height and shall be stenciled. Contractor shall not apply this to finished rooms such as offices, break rooms, or other normally occupied spaces finish with architectural type finishes.
- 4. Panels shall have machine printed panel schedules affixed to inside of door. Schedules shall indicate all circuits (including "SPARES" and "SPACES"), panel designation, origin and size of service feed, voltage, phase, and buss size.

3.3 INSTALLATION

- A. Coordinate and verify each item prior to installation of identification labeling.
- B. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Coordinate the installation of labeling to occur <u>after</u> the application of surface textures and/or painting of surfaces or equipment which may impair legibility of verbiage. Labeling shall also occur prior to the installation of any ceilings or barriers to make equipment generally inaccessible.
- D. Color tape shall be wrapped around individual conductors for 6 inches with 1/2 laps. Start and terminate wrap with three passes with no tension to prevent unraveling.
- E. Clean surfaces to have self-adhesive type markings applied with methods recommended by the marking's manufacturer.
- F. During backfilling of conduit trenches, install continuous underground warning tape directly above line at 6 to 8 inches below finished grade. Use multiple runs of tape where the width of the multiple lines installed in a common trench exceeds 16 inches.

END OF SECTION 26 05 53

SECTION 26 09 23 LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes requirements and specifications for time clocks, photocell switches, lighting contactors, occupancy sensors, etc..

1.2 GENERAL

A. Contractor shall furnish and install all lighting controls as called for on plans.

1.3 QUALITY ASSURANCE

- A. All devices shall be listed by Underwriters Laboratory, Inc. (UL).
- B. All installations shall be in accord with NFPA 70.

1.4 ACTION SUBMITTALS

- A. Section 01 33 00 Submittal Procedures Requirements for submittals.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: Show installation details for occupancy and light-level sensors to include field wiring diagrams.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 COORDINATION

A. Coordinate layout and installation of ceiling mounted devices with other ceiling construction, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Contactors shall be by:
 - 1. Square D
 - 2. G.E.
 - 3. Siemens
 - 4. Cuttler Hammer
- B. Time clocks shall be by:
 - 1. Tork
 - 2. Intermatic

2.2 CONTACTORS

- A. Pole quantities and ratings shall be as required on plans.
- B. Coordinate coil voltage with control type and plans.
- C. Contactor shall be electrically or mechanically held as required by plans. Contractor shall ensure switching of mechanical contactors uses a momentary on and momentary off signal.
- D. Contactor shall have a rating sufficient to withstand the available fault current at the point of installation.

2.3 TIME CLOCKS

- A. Time clocks shall be solid-state programmable units with alphanumeric display complying with UL 917.
- B. Provide enclosure suitable for installed environment.
- C. Battery backup (rechargeable) in case of power failure.
- D. Contacts are to be rated at 30 Amps.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install equipment level and plumb and in accord with manufacturer's written instructions.
- B. Contactors shall be mounted with vibration isolators to eliminate structure borne vibration.

3.2 INSPECTION

- A. Verify and test operation of <u>each</u> sensor used. Replace any non-functioning devices.
- B. Clean and replace any damaged lenses.

END OF SECTION 26 09 23

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SECTION 26 24 16 PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes requirements and specifications for distribution and branch circuit panelboards.

1.2 GENERAL

A. The terms "panelboards" and "loadcenters" are synonymous; see panel schedules to determine construction types.

1.3 ACTION SUBMITTALS

- A. Section 01 33 00 Submittal Procedures Requirements for submittals.
- B. Product Data: Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes for each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated.
- C. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 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. Detail features, characteristics, ratings, and factory settings of individual over-current protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.
 - 8. Include coordinated time-current curves for each type and rating of over-current protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of over-current protective device.
- D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of over-current protective device that allows adjustments.

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1.4 QUALITY ASSURANCE

- A. All panelboards and their assemblies shall be UL listed.
- B. All panelboards, overcurrent devices, components, etc. are to be obtained from a single manufacturer.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All panelboards shall be dead-front, safety type.
- B. Circuit breaker panelboards shall have sequence-phased bus bars and molded case circuit breakers. Provide separate ground and neutral busses. Circuit breakers shall be quick-make, quick-break, trip indicating, each pole shall contain thermal and magnetic trip units. Provide 2 and 3 pole circuit breakers with common trip, without relying on handle ties. Submit shop drawings showing cabinet dimensions, circuit breaker electrical ratings and bussing arrangements.
- C. Panelboards with aluminum phase, neutral, or ground buss are not acceptable. All bussing shall be copper.
- D. "Wafer" or "Tandem" breakers are not permitted unless specifically called for.
- E. Panelboards shall be fully rated to interrupt the available fault current at their terminals.
- F. All branch circuit breakers shall be bolt-on type.

2.2 MANUFACTURERS

- A. Acceptable manufacturers are as follows:
 - 1. Square D
 - 2. General Electric (GE)
 - 3. Cuttler Hammer
- B. Other manufacturers may be provided with prior approval.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all boards prior to installation. Reject any that show signs of water intrusion.

3.2 INSTALLATION

- A. All branch distribution equipments shall be of PANELBOARD or LOADCENTER construction, see schedules for determination.
- B. It is not permitted to flush mount panelboards in fire rated walls.

- C. Contractor shall install (4) 3/4" conduits into ceiling space for future use where the panelboard is installed flush. These conduits are in addition to conduits required for proposed circuitry. These conduits are required even on installations using cable type (MC, NMC, AC, etc.) wiring methods.
- D. All equipment to be set plumb and level.
- E. No equipment to be installed prior to drying-in of equipment spaces.
- F. All equipment layouts are to be coordinated with other trades.
- G. Any unused spaces shall be filled with manufacturer's filler plates.
- H. Adjust any field adjustable trip settings on overcurrent devices.

3.3 FIELD QUALITY CONTROL

- A. Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Test resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
- C. Test continuity of each circuit.
- D. Perform each visual inspection, mechanical inspection, and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters. Correct any malfunctioning equipment on-site, retest to verify compliance, or replace with new and retest.
- E. Prepare inspection test reports. Include any deficiencies found and corrective measures taken.

3.4 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Prior to 60 days of final acceptance by the Owner, measure load balancing and make circuit changes where required. A panel is to be considered not balanced if any of its phase loads differ by more than 20%.
 - 1. Measurements to be taken during normal system loading.
 - 2. Circuit changes are to be made after normal hours of operation.
 - 3. Recheck loading after circuit changes have been made.

END OF SECTION 26 24 16

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SECTION 26 27 13 ELECTRICAL METERING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes requirements and specifications for electrical metering equipment.

1.2 GENERAL

A. Contractor shall coordinate installation of all metering devices with local electric utility company for approved metering types.

1.3 ACTION SUBMITTALS

- A. Section 01 33 00 Submittal Procedures Requirements for submittals.
- B. Product Data: Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes for each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated.
- C. Shop Drawings: For each meter enclosure.
 - 1. Include dimensioned plans, elevations, sections, and details.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail current and voltage ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering equipment which may be incorporated in the work are:
 - 1. Square D
 - 2. General Electric (GE)
 - 3. Cuttler Hammer
 - 4. Millbank
 - 5. or preapproved equal

2.2 GENERAL

- A. Equipment shall have sufficient capacity to withstand a symmetrical fault of a size listed on plans or as provided by local electric utility company.
- B. Provide blank metallic cover plate for all unused meter sockets.
- C. Metering intended for use on commercial type installations shall incorporate a by-pass lever.
- D. All equipment shall be listed for installation in the proposed environments (NEMA 1, 3R, etc.).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Contractor shall install multi-section meter centers with its main device in the center.
- B. Contractor shall lay out meter center in a logical manner.
- C. Contractor shall clearly label each meter as to the Unit/Tenant which it serves.

END OF SECTION 26 27 13

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SECTION 26 27 26 WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes requirements and specifications for receptacles, switches, and other similar devices.

1.2 QUALITY ASSURANCE

- A. All products shall be UL listed.
- B. All devices are to be obtained from a single manufacturer insofar as they are available.
- C. All products shall comply with NFPA 70.

1.3 ACTION SUBMITTALS

- A. Section 01 33 00 Submittal Procedures Requirements for submittals.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

- A. Wall switches shall be specification grade, quiet type, high performance switches rated at 20 amps @ 125/277 volts.
- B. Switches shall have screw terminals and silver alloy contacts. No push wire connections permitted.
- C. Special switches shall be as indicated.
- D. Devices to be white.

2.2 RECEPTACLES

- A. Wall receptacles shall be specification grade, duplex 3-wire grounding type. Devices shall be rated at 15 or 20 amps (see drawing legend), 125 volt. If a single receptacle serves only one piece of equipment and is fed by a 20 amp or larger breaker, the device shall match the breaker in ampacity.
- B. Receptacles shall be side-wired with screw terminals. No push wire connections permitted.
- C. Weatherproof receptacles shall have latching, in-use type, hinged, gasketed. Use Thomas & Betts #CKSUV type cast aluminum cover.
- D. Special outlets shall be as indicated, or if not indicated, shall be straight-blade type of NEMA configurations according to size and type of branch circuit overcurrent device.
- E. Device to be white.

2.3 WALL PLATES

- A. Cover plates for devices shall be of same manufacturer as devices and shall be as indicated in the drawing symbol legend.
- B. Color to be white.
- C. Gang plates shall be of one-piece construction.

2.4 MANUFACTURERS

- A. All devices on the project shall be by the same manufacturer.
- B. Subject to the requirements of this section, the following are acceptable manufacturers:
 - 1. Thomas & Betts
 - 2. Leviton,
 - 3. Pass & Seymour
 - 4. Bryant
 - 5. Hubbell

PART 3 - EXECUTION

3.1 LOCATION OF SWITCHES AND RECEPTACLES

- A. Except where noted to contrary, switches and receptacles shall be located as follows: (Dimensions to centerline)
 - 1. Switches at 4'-0", or as noted.
 - 2. Receptacles at 1'-6", or as noted.
 - 3. The Electrical sub-contractor is responsible for coordinating the mounting height of devices above counter tops, wall furniture, etc., with the Client/Owner.
- B. Coordinate with the Owner for locations of all light switches.

3.2 WALL SWITCHES

- A. Switches shall be installed such that they are tight and flat against the wall.
- B. Screw terminals shall be utilized. No "push wire" connections are permitted

3.3 RECEPTACLES

- A. Receptacles shall be installed such that they are tight and flat against the wall.
- B. Screw terminals shall be utilized. No "push wire" connections are permitted

3.4 WALL PLATES

- A. Plates shall be installed so as to be tight and flat against the wall.
- B. Contractor shall affix a label to each wall plate indicating the enclosed device circuit of origin. This label shall be placed on the front of wall plate and shall be permanently engraved.

3.5 FIELD QUALITY CONTROL

- A. Test receptacle voltage at +/- 10% of nominal voltage.
- B. Test resistance to ground to be less than or equal to 2 Ohms.
- C. Test all ground fault interrupters.
- D. Verify all devices are securely mounting within their boxes.

END OF SECTION 26 27 26

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SECTION 26 29 13 ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes requirements and specifications for electrical motor controllers.

1.2 SCOPE

A. Contractor shall provide all equipment, materials and wiring necessary for complete installation of the systems herein specified and as shown on the plans, as well as those on the mechanical, plumbing, and civil drawings.

1.3 GENERAL

- A. Furnish and install power wiring, disconnects, starters, and other devices for all electrically operated equipment furnished by the Owner or other Contractors or as shown on the mechanical, plumbing, and civil plans and the Power Riser Diagram.
- B. This Contractor shall refer to other divisions of the specifications and specifically to the mechanical, plumbing, and civil drawings. The Electrical Contractor shall be responsible for all wiring and electrical devices not specifically provided in other divisions.

1.4 ACTION SUBMITTALS

- A. Section 01 33 00 Submittal Procedures Requirements for submittals.
- B. For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.
- C. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.
 - 1. Show tabulations of the following:
 - a. Each installed unit's type and details.
 - b. Factory-installed devices.
 - c. Nameplate legends.
 - d. Short-circuit current rating of integrated unit.
 - e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.
 - f. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
- D. Qualification Data: For qualified testing agency.
- E. Field quality-control reports.
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- F. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
- G. Routine maintenance requirements for enclosed controllers and installed components.
- H. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
- I. Manufacturer's written instructions for setting field-adjustable overload relays.
- J. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

1.5 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of motor starters, of types, ratings and characteristics required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Comply with NFPA 70 as applicable to wiring methods, construction and installation of motor starters.
- C. Provide motor starters and components which are UL listed and labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Subject to compliance with requirements, manufacturers offering motor starters which may be incorporated in the work are:
 - 1. Square D.
 - 2. G.E.
 - 3. Cuttler Hammer

2.2 MOTOR STARTERS:

- A. General: Except as otherwise indicated, provide motor starters and ancillary components which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation.
 - Combination magnetic, full voltage starters for three phase motors shall be three pole horsepower rated, magnetically operated switches, with three thermal overload units and four extra auxiliary contacts. Control voltage shall be 120 volts supplied from a control power transformer where no other supply of 120V control power is indicated. A three pole horsepower rated, non fusible disconnect switch shall also be included in the enclosure. An HOA switch shall be mounted in front cover. Starters shall have pilot lights indicating RED = OFF and GREEN = ON.

PART 3 - EXECUTION

3.1 EXAMINATION

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- A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install motor starters as indicated, in accordance with equipment manufacturer's written instructions and with recognized industry practices; complying with applicable requirements of NEC, UL and NEMA standards, to insure that products fulfill requirements.
- B. Motor and equipment locations indicated on the drawings are approximate only. Actual locations must be confirmed on the job site before conduits are installed. Coordinate all motor and equipment exact locations with the mechanical drawings and mechanical shop drawings as well as the civil drawings and civil shop drawings.
- C. Equipment connections shall include but not necessarily be limited to those noted on the drawings.
- D. All motors shall be fed with flexible conduit as noted on the drawings and specifications with appropriate connectors. Provide and install a separate bond conductor, sized from N.E.C. Table #250-122 in all flexible conduits to motors or equipment.
- E. Install fuses in control circuits if not factory installed. Comply with requirements in Division 26 Section "Fuses."
- F. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

3.3 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers and remote devices.
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control selection devices where applicable.
- D. Connect selector switches to bypass only those manual- and automatic- control devices that have no safety functions when switch is in manual-control position.
- E. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Acceptance Testing Preparation:

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- D. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
- E. Test continuity of each circuit.
- F. Tests and Inspections:
- G. Inspect controllers, wiring, components, connections, and equipment test and adjust controllers, components, and equipment.
- H. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
- I. Test continuity of each circuit.
- J. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Engineer before starting the motor(s).
- K. Test each motor for proper phase rotation.
- L. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- M. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- N. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- O. Enclosed controllers will be considered defective if they do not pass tests and inspections.
- P. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.
- C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer before increasing settings.

3.6 **PROTECTION**

A. Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

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B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

END OF SECTION 26 29 13

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SECTION 26 43 13 SURGE PROTECTIVE DEVICES FOR LOW VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes requirements and specifications for surge protective devices.

1.2 WORK INCLUDED

- A. The work required under this section shall include all materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building electrical and electronics systems from the effects of line induced transient voltage surge and lightning discharge as indicated on drawings or specified in this section.
- B. Related work specified elsewhere:
 - 1. COMMON WORK RESULTS FOR ELECTRICAL
 - 2. GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1.3 QUALITY ASSURANCE

- A. All surge protective devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electrical and electronics systems equipment.
- B. The surge protective devices manufacturer shall offer technical assistance through support by a factory representative and local stocking distributor.
- C. Items shall be listed by Underwriters' laboratories, shall bear the UL seal and be marked in accordance with referenced standard.
- D. Surge protective devices shall be installed and located in accordance with requirements of all applicable National Fire Protection Association (NFPA) Codes.

1.4 WARRANTY

- A. All surge protective devices shall be warranted to be free from defects in materials and workmanship under normal use in accordance with the instructions provided for a period of five years.
- B. Any surge protective device which shows evidence of failure or incorrect operation during the warranty period shall be repaired or replaced by the manufacturer and installer.

1.5 CODES AND STANDARDS

- A. The following standards and publications are referenced in various parts of this specification and shall apply:
 - 1. UL 1449 Standard for Surge Protective Devices
 - 2. UL 1363 Standard for Relocatable Power Taps
 - 3. UL 1283 Standard for Safety for Electromagnetic Interference Filters

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- 4. ANSI/IEEE C62.41 (IEEE 587) Guide for Surge Voltages in Low-Voltage AC Power Circuits.
- 5. ANSI/IEEE C62.33 Standard Test Specifications for Varistor Surge Protection Devices.
- 6. ANSI/IEEE C62.45 IEEE Guide for Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.

1.6 ACTION SUBMITTALS

- A. Section 01 33 00 Submittal Procedures Requirements for submittals.
- B. Schematic data on each suppressor type indicating component types.
- C. Dimensioned drawing of each suppressor type.
- D. Manufacturer's performance data on each suppressor type to include short circuit rating, voltage protection rating for all modes, maximum continuous operating voltage, I-nominal rating, and Type 1 device listing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Surge protective devices shall be by panel manufacturer.
- B. See plans for locations and required protection levels.

2.2 COMMON REQUIREMENTS

- A. Surge protective devices for flush mounted panelboards shall be within the panelboard.
- B. Surge protective devices shall have an operating temperature range of -40 degrees C to +85 degrees C.
- C. Surge protective devices shall be designed for the specific type and voltage of electrical service and shall provide clamping action for line to neutral and line to ground.
- D. Surge protective devices shall be designed to withstand a maximum continuous operating voltage of not less than 115% of nominal RMS line voltage.
- E. Surge protective devices shall contain internal safety fusing which is designed to disconnect the suppressor from the electrical source if the suppressor fails.
- F. Surge protective devices shall be failsafe, shall have repeated surge capability, shall be solid state, shall be self-restoring, and shall be fully automatic.
- G. Surge protective devices shall contain a visual indication at the suppressor to verify that either the suppressor has failed or that the suppressor is operational and functional.
- H. Surge protective devices shall be UL 1449 listed and shall be approved for the location in which they are installed.

PART 3 - EXECUTION

3.1 REQUIRED SUPPRESSORS

A. Provide surge protective devices in locations indicated on the design plans.

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3.2 INSTALLATION

A. Surge protective devices shall be installed directly onto the panel bussing.

END OF SECTION 26 43 13

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SECTION 26 51 00 INTERIOR LIGHTING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes requirements and specifications for interior normal and emergency lights.

1.2 GENERAL

A. Fixtures have been designated in accordance with fixture schedule located on the drawings. If any fixture is not clearly identified, Contractor shall request clarification from the Engineer.

1.3 QUALITY ASSURANCE

- A. Provide and install, in satisfactory operating condition, lighting fixtures as indicated or required for a complete and operable lighting system.
- B. All light fixtures shall be listed be Underwriters Laboratories, Inc (UL).
- C. Contractor shall submit full shop drawings of all light fixtures proposed. Shop drawings shall include fixture manufacturer cut sheets with all options clearly indicated, photometric plot, efficiency, light fixture sectional views, etc..
- D. Light fixtures shall be evaluated for equality based upon features such as construction, materials, lensing, color, finish, performance, etc.. If prior approval has not been granted, in writing, for substitution of a light fixture, and in the opinion of the Engineer, a fixture does not meet the requirements of the design said fixture shall be replaced with an acceptable fixture at no additional cost to the Owner.
- E. Upon request, contractor shall furnish full size, fully operational samples of any light fixture to Engineer.
- F. All fixtures to comply with NFPA 70.

1.4 ACTION SUBMITTALS

- A. Section 01 33 00 Submittal Procedures Requirements for submittals.
- B. For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Driver.
 - 4. Energy-efficiency data.
 - Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Efficient Lighting Products.
 - 6. Warranties

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PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES

- A. Light fixtures shall be as specified on Electrical plans. Contractor shall issue the entire light fixture schedule (part numbers and description) to lighting supplier for take-offs. In addition, a full size print of the lighting plan shall also be furnished. If any conflicts or discrepancies are located, contractor shall immediately notify the Engineer and get written clarification. "Cross Over" fixture packages are allowed and shall be reviewed by the Engineer and considered for approval. Verify from light fixture schedule as to whether "Prior Approvals" are or are not required for submission. Note that all alternate packages are subject to rejection by Engineer.
- B. Adjustable lighting fixtures intended to produce a desired lighting effect shall be so adjusted.
- C. Provide all required rings, trims, hangers, clips, etc. for a complete installation.
- D. Warranties
 - 1. For emergency lighting unit batteries, ten years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fixtures shall be set level, plumb, and square with ceilings and walls.
- B. Clean and touch up all fixture reflectors, lenses, and housings after installation.
- C. Adjust any aimable fixtures as necessary.

3.2 INSPECTION

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Verify normal operation of each fixture after installation.
- C. Interrupt power supply to each emergency light fixture to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal.

END OF SECTION 26 51 00

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SECTION 26 56 00 EXTERIOR LIGHTING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes requirements and specifications for exterior light fixtures.

1.2 GENERAL

A. Fixtures have been designated in accordance with fixture schedule located on the drawings. If any fixture is not clearly identified, Contractor shall request clarification from the Engineer.

1.3 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4.

1.4 QUALITY ASSURANCE

- A. Provide and install, in satisfactory operating condition, lighting fixtures (including auxiliaries) as indicated or required for a complete and operable lighting system.
- B. All light fixtures shall be listed be Underwriters Laboratories, Inc (UL).
- C. Contractor shall submit full shop drawings of all light fixtures proposed. Shop drawings shall include fixture manufacturer cut sheets with all options clearly indicated, photometric plot, efficiency, light fixture sectional views, etc..
- D. Light fixtures shall be evaluated for equality based upon features such as construction, materials, lensing, color, finish, performance, etc.. If prior approval has not been granted, in writing, for substitution of a light fixture, and in the opinion of the Engineer, a fixture does not meet the requirements of the design said fixture shall be replaced with an acceptable fixture at no additional cost to the Owner.
- E. Upon request, contractor shall furnish full size, fully operational samples of any light fixture to Engineer.
- F. All fixtures to comply with NFPA 70.

1.5 ACTION SUBMITTALS

- A. Section 01 33 00 Submittal Procedures Requirements for submittals.
- B. For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Energy-efficiency data.
 - 3. Life, output, and energy-efficiency data for LEDs.
 - 4. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with accessories identical to those indicated for the lighting fixture as applied in this project.

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- a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.
- b. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Efficient Lighting Products.
- 5. Warranties

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES

- A. Light fixtures shall be as specified on Electrical plans. Contractor shall issue the entire light fixture schedule (part numbers and description) to lighting supplier for take-offs. In addition, a full size print of the lighting plan shall also be furnished. If any conflicts or discrepancies are located, contractor shall immediately notify the Engineer and get written clarification. "Cross Over" fixture packages are allowed and shall be reviewed by the Engineer and considered for approval. Verify from light fixture schedule as to whether "Prior Approvals" are or are not required for submission. Note that all alternate packages are subject to rejection by Engineer.
- B. Provide all required rings, trims, hangers, clips, etc. for a complete installation.
- C. Warranties
 - 1. Warranty period for luminaires is to be five years from date of Substantial Completion.
 - 2. Warranty period for metal corrosion is to be five years from date of Substantial Completion.
 - 3. Warranty period for color retention is to be five years from date of Substantial Completion.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fixtures shall be set level, plumb, and square with walls.
- B. Poles shall be set plumb.
- C. Clean and touch up all fixture reflectors, lenses, and housings after installation.

3.2 INSPECTION

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Verify normal operation of each fixture after installation.

END OF SECTION 26 56 00