Rehabilitation of WMATA Parking Facilities
SHADY GROVE NORTH, GROSVENOR-STRATHMORE, FRANCONIA-SPRINGFIELD (EAST) AND COLLEGE PARK
For

Washington Metropolitan Area Transit Authority

Contract Number FQ 15090

VOLUME 2

Technical Specifications

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WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

REHABILITATION OF WMATA PARKING FACILITIES SHADY GROVE NORTH, GROSVENOR-STRATHMORE, COLLEGE PARK, AND FRANCONIA-SPRINGFIELD (EAST)

TECHNICAL SPECIFICATIONS

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SECTION 02250

SHORING

PART 1 GENERAL

1.01 SUMMARY

A. This work shall consist of providing the necessary labor, materials, equipment and supervision for the installation of shoring to support structural elements during execution of the work, as shown in the Contract Drawing.

1.02 SUBMITTALS

A. Contractor shall submit shop drawings for the temporary shoring shown in the Contract Drawings

B. Temporary Shoring Plans: Temporary shoring plans shall be submitted with design calculations and supporting data for review and approval by the AR and Quality Control Engineer. Shop drawings and calculations shall be sealed by a Professional Engineer, licensed in the Commonwealth of Virginia and state of Maryland. Shop drawings shall include all details and components required to construct the temporary shoring, design loadings, specifications, required inspection and testing, material specifications and procedures for erection.

PART 2 PRODUCTS

2.01 MATERIALS

A. The Contractor shall submit copies of product literature showing capacities and installation details for all shoring equipment.

B. Previously used materials may be used if approved by the AR. All previously used materials shall be designed with appropriate increase in factor of safety or decreased in design capacity to compensate for previous damage. The Contractor's Professional Engineer shall inspect and certify that previously used materials meet the requirements of the working drawings.

PART 3 EXECUTION

3.01 SHORING INSTALLATION

A. Shoring shall be installed in accordance with the Contract Drawings or the shop drawing submittals produced under Section 3.2. The shoring design in the Contract Drawings assumes a construction live load of 50 psf. If construction equipment, construction sequence, or Contractor means and methods produce a construction live load in excess of 50 psf, shoring shall be designed by the Contractor under Section

3.02. No demolition shall proceed prior to review and approval of the shoring installation by the Quality Control Engineer and the AR.

3.02 SHORING DESIGN REQUIREMENTS – TEMPORARY SHORING SYSTEMS

A. Design of Shoring components shall conform to accepted engineering practice. The minimum construction live load shall be 50 psf. Higher construction live loads shall be used if warranted by construction equipment, sequence, means and/or methods. If multiple level shoring is required, it shall be supplied and installed at no additional cost to the Authority. The work area size shall be adjusted as required so as not to exceed the maximum number of parking spaces which can be taken out of service at any one time as indicated in the Contract Drawings.

B. Design calculations shall be included for portions of the existing structure that will either directly or indirectly support the temporary shoring. As-built dimensions, materials, and conditions shall be based on the original plans and field verification by Contractor.

C. If the temporary shoring is to be directly supported by the existing structure, connections shall be made by direct bearing or the use of suitable anchors. If mechanical anchors (wedge anchors, sleeve anchors, expansion shields, or similar proprietary anchors) or adhesive or epoxy resin anchors are used in the shoring, installation of the anchors shall be monitored by the Quality Control Engineer. Inspection instructions shall be included in the submittal.

D. Special Shoring: Special shoring required to support demolition equipment loads shall also be designed and submitted in accordance with this section.

E. The Designer of the Alternate shoring system shall attend a site meeting to be attended by the AR, Quality Control Engineer and Contractor to review the alternate shoring system requirements with the parties.

3.03 SHORING INSTALLATION CERTIFICATION – TEMPORARY SHORING SYSTEMS

A. A Professional Engineer registered in the Commonwealth of Virginia and State of Maryland shall be retained by the Contractor and shall inspect the alternate shoring systems during and after installation in each work area or phase of construction and shall submit a written certification that the shoring has been installed in accordance with the approved shop drawings. If the shoring system is to be modified at various phases of the work, certification is required for each phase. No demolition shall proceed prior to review and approval of the certification by the AR.

3.04 ACCESS

A. Drive Lanes:
   1. Contractor shall provide warning devices, signs and guards for shoring components to protect shoring components from vehicle impact.

3.05 REMOVAL OF SHORING

A. Upon completion of the work, the Contractor shall remove all shoring materials from Authority property. Shoring may be removed when field cured concrete test specimens reach a compressive strength of 4000 psi. Concrete shall be tested in accordance with Specifications Section 03010 as applicable.

B. Anchor bolts and/or other connections to existing components shall be removed and all holes repaired in accordance with Section 03010.

END OF SECTION

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SECTION 02410

SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

A. The work shall consist of providing the necessary labor, materials, equipment and supervision for demolition and removal of selected portions of prestressed concrete parking structure.

1.02 RELATED SECTIONS

A. Section 01100 – Summary of Work

1.03 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Reinstall: Remove items as indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.

C. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the AR, items may be removed to an off-site, protected storage location, during selective demolition and then cleaned and reinstalled in their original locations.

1.04 MATERIALS

A. Except for items or materials indicated to be reused, reinstalled, or otherwise indicated to remain the Authority's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor’s option.

1.05 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Specifications Sections, unless otherwise indicated.

B. Proposed dust-control measures.

C. Proposed sediment, wastewater treatment, and debris control measures.

D. Proposed maintenance of traffic controls.

E. Proposed method of identifying and marking prestressing tendons.

F. Proposed shoring plans.

G. Proposed noise-control measures.

H. Schedule of selective demolition activities indicating the following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
   2. Interruption of utility services.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Use of elevator and stairs.
   5. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Authority's on-site operations.
   6. Coordination of Authority's continuing occupancy of portions of existing building.
   7. Locations of temporary partitions and means of egress.
   8. Public safety.
   9. Inventory of items to be removed and stored.

1.06 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

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

C. Pre-demolition Conference: Conduct conference at project site to comply with pre-installation conference requirements. The AR and Quality Control Engineer shall be present at all pre-demolition conferences and shall be solely responsible for granting the Contractor approval to begin demolition.

D. Standards: Comply with ANSI A10.6 and NFPA 241.

1.07 PROJECT CONDITIONS

A. Property immediately adjacent to selective demolition areas is occupied by others. Conduct selective demolition so Authority's operations will not be disrupted. Provide not less than 72 hours notice to Authority's of activities that will affect the operations.
   1. Comply with requirements specified in Division 01 Section 01110 "Summary of Work".

B. The Authority assumes no responsibility for actual condition of components to be selectively demolished.
   1. Conditions existing at time of inspection for bidding purposes will be maintained by Authority as far as practical.

2. Asbestos: it is not expected that asbestos will be encountered in the work. If any materials suspected of containing asbestos are encountered, do not disturb the materials. Immediately notify the AR.
   a. Asbestos will be removed by the Authority.
3. Lead: it is not expected that lead will be encountered in the work. If any materials suspected of containing lead are encountered, do not disturb the materials. Immediately notify the AR.
   a. Lead will be removed by the Authority.

C. Protection of the Prestressed Members: The existing structural double tees and beams at all garage levels are prestressed and contain bonded prestressed tendons. Extreme caution shall be used when any drilling, cutting, chipping or coring is to be performed by the Contractor. All such activities shall be cleared by the ground penetrating radar or X-ray. The Contractor shall be responsible for repair of prestressed tendons damaged by the Contractor's negligence.

D. Storage or sale of removed items or materials on-site will not be permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

1.08 SCHEDULING

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

1.09 WARRANTY

A. Existing Special Warranty: Remove, replace, patch and repair materials and surfaces cut, marred or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

B. Authority shall provide a list of existing warranties held on components that may be affected by selective demolition.

PART 2 PRODUCTS

2.01 REPAIR MATERIALS

A. Use repair materials identical to existing materials.
   1. Where identical materials are unavailable or cannot be used for exposed surfaces, sue materials that visually match existing adjacent surfaces to the fullest extent possible.
   2. Use materials whose installed performance equal or surpass that of existing materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been temporarily supported or moved, disconnected and/or capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to the AR.

E. Survey the condition of the garage structure to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during selective demolition.

F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain in service and protect them against damage during selective demolition operations.
   1. Do not interrupt existing utilities serving occupied or operating facilities, expect when authorized in writing by the Authority. Provide temporary services during interruptions to existing utilities, as acceptable to Authority and to governing authorities.
   2. Provide not less than 72 hours notice to Authority if shutdown of service is required during changeover.

B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services installed in or attached to components of the structures to be selectively demolished.
   1. Authority will arrange to shut off indicated utilities when required and requested by Contractor.
   2. Arrange to shut off indicated utility companies.
   3. Where utility services are required to be removed, relocated, or abandoned, provide bypass connectors to maintain continuity of service before proceeding with selective demolition.

C. Utility Requirements: See AR for temporary support, shutting off, disconnecting, removing and sealing or capping utility services. Do not start selective demolition

work until utility disconnecting and sealing have been completed and verified in writing.

3.03 PREPARATION

A. The Contractor shall be responsible for maintaining the garage drainage system, including drains, pipes, sumps, and pumps, open and functioning properly at all times. Prior to the start of demolition the Contractor shall clean all existing drains and snake drain lines to assure function. The Contractor shall flush or snake the system as often as necessary to comply with this requirement at no cost to the Authority. Upon completion of the project the Contractor shall clean all drains and snake drain lines to assure function.

B. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Authority and governmental authorities having jurisdiction.

C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of the public around selective demolition area.
   1. Erect temporary protection, such as walks, fences, overhead protection, shoring where required by authorities having jurisdiction.
   2. Protect existing finishes that are to remain and are exposed during selective demolition operations.
   3. Cover and protect components and equipment that have not been removed.
   4. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.

D. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
   1. Strengthen or add new supports when required during progress of selective demolition.

3.04 POLLUTION CONTROLS

A. Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental protection regulations.
   1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

B. Remove, collect, and transport wastewater, sediment and construction debris in a manner that will prevent spillage on adjacent surfaces areas and waterways.

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

3.05 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
   5. Maintain adequate ventilation when using cutting torches.
   6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
   7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
   8. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.
   9. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.

B. Remove and dispose of existing concrete debris, concrete sediment, reinforcing steel and other removed components from the site.

3.06 PATCHING AND REPAIRS

A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction by selective demolition operations.
   1. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
   2. Completely fill holes and depressions in existing concrete to remain with an approved patching material, applied according to manufacturer’s printed recommendations.

B. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.

3.07 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.08 CLEANING

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

B. Wash, rake or broom clean the work area, staging area, and areas adjacent and affected by the work on completion of selective demolition operation.

C. At the completion of the project, perform a complete wash down of the garage levels including floors, perimeter walls, columns, ceilings, stairwells and access roads.

END OF SECTION

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SECTION 02420

SELECTIVE ELECTRICAL DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: The work specified in this Section consists of material for demolition, replacement and salvaging existing electrical systems, wiring, raceways, supports, equipment and minor repair of underlying structure.

B. Related Sections:
   1. Refer to Procurement Documents

1.02 REFERENCES

A. Reference Standards
   1. U. S. Government:
      a. Federal Transit Administration (FTA):
   2. 49 CFR 661 Buy America Requirements

B. National Fire Protection Association (NFPA):
   1. NFPA 70 National Electrical Code (NEC)

1.03 SUBMITTALS

A. Submit demolition plan.

1.04 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Buy America Act:
      a. Except for those products which are exempt under the specific statutory waivers stipulated in 49 CFR 661, all other products supplied under this Section must comply with the requirements of the Buy America Act.

1.05 COORDINATION AND SEQUENCING

A. Coordinate all power outages with Authority.

B. Perform demolition and replacement in a manner not to delay or interfere with other operations of work in the Project and operations of the Authority.

1.06 SCHEDULING

A. Schedule all work with the Authority through the Authority's designated representative. Start no work in an area until a schedule has been prepared, submitted and approved.

B. Coordinate the work schedule with the Authority, and other Contractors. Coordinate the work so not to interfere or conflict with the performance of work by the Authority and the Authority's tenants.

1.07 PROJECT/SITE CONDITIONS

A. Contractor shall use care not to impede the ongoing work of any tenant.

B. Demolition and replacement work, as specified herein, is not intended to be performed as a wrecking operation but as work relative to the performance of the various construction operations of the Project.

C. Existing Conditions:
   1. Demolition information shown or otherwise indicated on the Drawings is based on visual field examination. While the information provided is believed to be correct, no assurance is implied relative to its total completeness or accuracy. Report discrepancies to Construction Manager for disposition of the Authority before disturbing existing installations.
   2. The Contractor hereby distinctly agrees that neither the Construction Manager, the Engineer nor the Authority is responsible for the correctness or sufficiency of the information given and after his own Site Investigation:
      a. That he must have no claim for delay or extra compensation or damage on account of the information given; and
      b. That he must have no claim for relief from any obligation or responsibility under the Contract with respect to the above stated stipulations.

D. Protection: Exercise care during demolition work to confine demolition operations to the areas as indicated on the Drawings. The physical means and methods used for protection are at the Contractor's option. However, the Contractor will be completely responsible for replacement and restitution work, of whatever nature, at no expense to the Authority.
   1. Additionally, if public safety is endangered during the progress of the demolition work, provide adequate protective measures to protect public pedestrian and vehicular traffic on streets and walkways.
   2. Conform signs, signals and barricades to requirements of Federal, State and local laws, rules, regulations, precautions, orders and decrees.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Basic Electrical Materials: Those products such as conduit, raceway, wire and cable, support devices, fasteners, and control devices as required for work of this Section are specified in other Sections.

B. Equipment along with machinery and apparatus, motorized or otherwise, used to perform the demolition may be chosen at the Contractor's discretion. However, the chosen equipment shall perform the work within the limits of the Contract requirements.

C. Patching Materials: Patching materials shall match, as nearly as practical, the existing material for each surface being patched.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify that measurements and existing circuiting arrangements are as shown on Drawings.

B. Equipment, machinery and apparatus, motorized or otherwise, used to perform the demolition work may be used as chosen at the Contractor's discretion, but which will perform the work within the limits of the Contract requirements.

C. Verify that abandoned wiring and electrical equipment serve only the abandoned facility.

3.02 DEMOLITION

A. General: The means and methods of performing electrical demolition and removal operations are the sole responsibility of the Contractor except as otherwise specified. Use equipment and methods that do not damage items to remain or salvaged and areas adjacent to demolition operations. Use methods that do not interfere with Authority's operations and which do not cause excessive dust. Remove debris as it accumulates.

B. Equipment used, and methods of demolition and removal will be subject to approval of the Construction Manager and the Authority.

C. System De-activation: Prior to demolition and removal work, de-activate existing electrical systems.

D. Use means and methods for permanent disconnection, which render the remaining electrical systems and apparatus in conformity with NFPA 70.

E. Coordinate electrical power outages with requirements in Section 16050.

F. Cutting: Perform cutting work of existing structure materials by such methods as will prevent extensive damage beyond the immediate area of cutting.

G. Debris Removal: Dispose of demolition debris off site in a lawful manner. Containerize or otherwise store debris as work is in progress.

H. Patching: After demolition and removal work is performed patch the existing structure as required to match surrounding finish and appearance including the appropriate surface decoration.

I. Abandoned Electrical Equipment and Apparatus: Existing electrical equipment and apparatus in or on the structures not claimed as salvage by the Authority shall

become the property of the Contractor and may not be disposed of on the site but removed and disposed of in a lawful manner off-site.

J. Salvage: The Authority shall have the right to claim as salvage any items and materials removed under the work of this Section. Should such right of salvage be exercised by the Authority, move and neatly store removed items on the site in a location agreeable to the Authority and in a manner approved by the Authority.

END OF SECTION

SECTION 03010

MAINTENANCE OF CONCRETE

PART 1 GENERAL

1.01 SUMMARY:

A. Section Includes: The work specified in this section consists of repairs to portions of the existing concrete. Types of repair to be made include but are not limited to:
   1. Repair of surface spalls and cracks in existing concrete.
   2. Installation of drainage hose at locations of severe water infiltration.

1.02 REFERENCES:

A. ASTM International (ASTM):
   1. ASTM C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   2. ASTM C109, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
   3. ASTM C267, Standard Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacings and Polymer Concretes.
   4. ASTM C348, Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
   5. ASTM C496, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
   6. ASTM C1202, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.
   7. ASTM D1042, Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

B. Army Corps of Engineers (USACE):
   1. CRD C48, Standard Test Method for Water Permeability of Concrete

C. American Concrete Institute (ACI):
   1. ACI 301-10 Specifications for Structural Concrete.

1.03 SUBMITTALS:

A. Product Data: Submit manufacturer's descriptive product data and current specifications for materials proposed for the work of this section. Provide a certification stating that the repair materials meet the specified requirements.

1.04 QUALITY ASSURANCE:

A. Concrete Repair Product Manufacturer Qualifications: The manufacturer of the specified product shall have in existence, for a minimum of 10 years, a program of training, certifying, and technically supporting a nationally organized Approved Contractor Program with annual re-certification of its participants.

B. Contractor Qualifications: Contractor shall have at least five years of experience in concrete repair services. The Contractor shall also be an Approved Contractor of the manufacturer of the specified product, who has completed a program of instruction in the use of the specified material, and shall provide a notarized certification from the manufacturer attesting to their Approved Contractor status.
   1. Contractors shall provide the Engineer with two job references where they have successfully repaired existing concrete with the specified product.

C. Manufacturer's Representative Services: The Contractor shall arrange for and provide the services of the product manufacturer's technical representative to be on-site during the start up repair operation.
   1. Services shall include detailed instructions to the Contractor's personnel on the use of the concrete repair material.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Delivery and Handling: Deliver the specified product in original, unopened containers with the manufacturer’s name, labels, product identification, and batch numbers.

B. Storage: Store the specified product as recommended by the manufacturer.

1.06 PROJECT CONDITIONS:

A. The Contractor shall inspect the existing concrete surfaces and confirm the location, limits, and type of repair required. Repairs of deteriorated concrete specified by quantities listed on the Contract Drawings. The Contractor shall not perform any repair work without prior approval of the Engineer.

B. Reinforcement may be encountered within the repair region.

PART 2 PRODUCTS

2.01 CEMENTITIOUS POLYMER MORTARS:

A. Crack Injection: Low viscosity, expanding, polyurethane chemical grout to stop water infiltration
   1. NSF/ANSI 61 approved for potable water content
   2. Tensile Properties, ASTM D 638
      a. Tensile Strength: 29 psi

3. Elongation Properties
   a. Elongation 44%
4. Shrinkage Properties, ASTM D1042
   a. Less than 1%
5. Acceptable Manufacturer:
   a. Sika Corporation: SikaFix HH LV

B. Cementitious Crystalline Waterproofing: Blend of portland cement, fine treated silica sand and active chemicals that react with water to form a non-soluble crystalline formation of dendritic fibers within the pores and capillary tracts of concrete.
   1. Crystalline Penetration: Crystallizing capability of waterproofing material shall be evidenced by independent SEM (Scanning Electron Microscope) photographs documenting penetration of crystal-forming waterproofing material to a depth of 2 inches (50 mm).
   2. Permeability: Independent testing shall be performed according to U.S. Army Corps of Engineers CRD C48 “Permeability of Concrete.”
      a. Concrete samples (treated and untreated) to have design strength of 2000 psi (13.8 MPa) and thickness of 2 inches (50 mm). No admixtures permitted.
      b. Coatings to have maximum thickness of 0.05 inches (1 mm) per coat with up to two coats permitted.
      c. Samples to be pressure tested to 175 psi (405 foot head of water) or 1.2 MPa (123.4 m head of water).
      d. Treated samples, after crystalline growth has occurred, shall exhibit no measurable leakage.
   3. Chemical Resistance: Independent testing shall be performed according to ASTM C267 “Chemical Resistance of Mortars” and ASTM C39 “Compressive Strength of Cylindrical Concrete Specimens.”
      a. Concrete samples (treated and untreated) to have design strength of 4000 psi (27.6 MPa). No admixtures permitted.
      b. Coatings to have maximum thickness of 0.05 inches (1 mm) per coat with up to two coats permitted.
      c. Untreated and treated specimens to be immersed for a minimum of 84 days in following chemical solutions: hydrochloric acid (3.5pH), brake fluid, transformer oil, ethylene glycol, toluene, caustic soda.
      d. Treated specimens shall exhibit no detrimental effects after exposure, and shall have a minimum of 14% increase in compressive strength versus untreated control specimens.
   4. Acceptable Manufacturer:
      a. Xypex Chemical Corporation

C. Polymer Repair Mortar:
   1. Repair of Horizontal Surfaces :

a. Polymer-modified, cementitious, 2-component, free-flow self-leveling mortar such as SikaTop 111 Plus as manufactured by Sika Corporation.
b. Polymer-modified, cementitious, 2-component, trowel-grade patching mortar such as SikaTop 122 Plus as manufactured by Sika Corporation.

2. Repair of Vertical and Overhead Surfaces (Type F & V Concrete Repair):
   a. Polymer-modified, cementitious, 2-component, fast-setting mortar such as SikaTop 123 Plus, Gel Mortar, as manufactured by Sika Corporation.

D. Bonding Compound
   1. Provide Bonding Compound on excavated surfaces
   2. Acceptable Manufacturer:
      a. Sika Corporation: Sika Armatec 110 EpoCem

E. Crack Injection, Structural Repair: A two-component, super low-viscosity, crack healing, epoxy resin for both dry and damp cracks that structurally improves concrete surface.
   1. Tensile Properties, ASTM D-638
      a. Tensile Strength at 7 days: 7,100 psi
   2. Bond Strength, ASTM C-882
      a. Hardened Concrete to Hardened Concrete at 2 days: 2,500 psi
      b. Hardened Concrete to Steel at 2 days: 1,500 psi
   3. Flexural Properties, ASTM D-790
      a. Flexural Strength at 7 days: 8,500 psi
   4. Shear Strength, ASTM D-732
      a. Shear Strength at 7 days: 5,800 psi
   5. Compressive Properties, ASTM D-695
      a. Compressive Strength at 28 days at 90°F: 10,000 psi
   6. Acceptable Manufacturer:
      a. Sika Corporation: Sikadur 55 SLV

F. Gravity Crack Repair: Low viscosity, high strength epoxies resin.
   1. Tensile Properties, ASTM D-638
      a. Tensile Strength at 7 days: neat 8,900 psi
   2. Bond Strength, ASTM C-882
      a. Bond Strength at 2 days 4,000 psi
   3. Compressive Properties, ASTM D-695
      a. Compressive Strength at 28 days: neat at 90 degrees 10,500 psi
   4. Acceptable Manufacturer:
      a. Sika Corporation: Sikadur 35, Hi-Mod LV

2.02 CAST-IN-PLACE CONCRETE

A. Concrete Type V
   1. Repair material for small vertical surfaces and overhead surfaces (repair surface area less than 2 sq. ft.). Materials shall be specifically

manufactured for hand application in lifts to vertical and overhead surfaces. Polymer modified materials are acceptable. Materials shall have the following minimum properties:

Test	Method	Criteria	Result
Bond Strength	ASTM C-882	Bond to hardened concrete, no bonding agent. Material may be scrubbed into bond surface.	2,000 psi min.
Compressive Strength	ASTM C-109	28 days	5,000 psi min.
Shrinkage	ASTM C-157	Air Storage @ 28 days	0.05% max.

B. Concrete Type F

1. Repair material for formed poured and or formed and pumped repairs, vertical and overhead surfaces (repair surface area greater than 2 sq. ft.). Polymer modified materials are acceptable. Materials shall have the following minimum properties:

Test	Method	Criteria	Result
Bond Strength	ASTM C-882	Bond to hardened concrete, no bonding agent. Material may be scrubbed into bond surface.	2,000 psi min.
Compressive Strength	ASTM C-109	28 days	5,000 psi min.
Shrinkage	ASTM C-157	Air Storage @ 28 days	0.05% max.

C. Concrete Type 1

1. Ready Mix Concrete for horizontal surfaces per ACI 301-10

D. Concrete Type 2

1. Proprietary repair material for horizontal surfaces or polymer modified cementitious mortar extended with aggregate are acceptable. Materials shall have the following minimum properties:

Test	Method	Criteria	Result
Bond Strength	ASTM C-882	Bond to hardened concrete, no bonding agent. Material may be scrubbed into bond surface.	2,000 psi min.
Compressive Strength Entrained Air	ASTM C-39, 3”x6” cylinders ASTM C173 ASTM C231	28 days At Point of Placement	5,000 psi min. 6+/-2%
Freeze Thaw Resistance Shrinkage	ASTM C666 ASTM C-157	 Air Storage @ 28 days	100% RDM 0.065% max.

2.03 DRAINAGE HOSE INSTALLATION

A. Modular Seal Assembly
   1. Seal shall be modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening.
      a. Elastomeric element shall be sized and selected per manufacturer's sizing procedure.
   2. Modular seal pressure plates shall be a uniform pressure plate design molded of glass reinforced Nylon Polymer.
   3. Modular seal hardware shall be sized according to the manufacturer's technical data. Bolts, allen head/flange hex nuts shall be either:
      a. Mild Steel with a 60,000 psi minimum tensile strength and 2-part Zinc Dichromate coating.
      b. 316 Stainless Steel with a 85,000 psi average tensile strength.
   4. Acceptable Manufacturer:
      a. PSI-Thunderline/Link-Seal

B. Thick-Wall PVC Pipe and Pipe Fittings
   1. Threaded (NPT) Schedule 80 Pipe Nipple
      a. Threaded on one end
      b. 1 ½" Pipe Size
   2. 90° Elbow
      a. Female NPT Threaded Ends
      b. 1 ½" Pipe Size
   3. By McMaster-Carr or equal.

C. Nylon Extra-Grip Barbed Tube Fittings
   1. Straight Adapter
      a. Tube-to-Male Threaded Pipe
      b. 1 ½" Pipe Size
   2. 90° Elbow
      a. Tube-Tube
      b. 1 ½" Pipe Size
   3. By McMaster-Carr or equal.

D. Flexible Tubing: High-Pressure PVC Tubing
   1. Walls of tubing to be embedded with polyester braid
   2. Clear walled tubing
   3. By McMaster-Carr or equal.

2.04 MATERIAL SUBSTITUTIONS:

A. The use of other than the specified products will be considered providing the contractor requests their use in writing to the Engineer. This request shall also be accompanied by (a) A certificate of compliance from an approved

independent testing laboratory that the proposed substitute products meet or exceed the specified performance criteria, tested in accordance with the specified test standards; and (b) Documented proof that the proposed substitute products have a five year proven record of performance, confirmed by actual field tests and five successful installations that the Engineer can investigate.

PART 3 EXECUTION

3.01 PREPARATION:

A. Repair procedures are defined in this section with additional guidelines given on the Contract Drawings.

3.02 INJECTION REPAIR CONCRETE CRACKS/JOINTS:

A. Repair Procedure:
   1. Crack must be clean and sound. All efflorescence shall be removed prior to injecting.
   2. Drill 5/8” diameter holes along the side of the crack/joint at a 45° angle.
   3. Follow manufacturer’s recommendations for installation.
   4. Once ports are used and crack/joint is completely injected, knock off outside of port, and cover the hole with polymer repair mortar.

3.03 CEMENTITIOUS CRYSTALLINE WATERPROOFING:

A. General: This work consists of repair of cracks as indicated on the drawings.
   1. Rout out crack in a “U” shaped slot 1” wide and at least 1.5” deep. A “V” shaped slot is not acceptable.
   2. Remove all loose material and saturate with water. Allow water to soak into concrete and then remove all surface water.
   3. Apply one slurry coat at a coverage of 1.5 lb./sq. yd. to slot and to 6” strip on either side of slot. Application may be performed by brush or gloved hand.
   4. While slurry coat is still tacky, fill slot to surface. Compress it tightly using a pneumatic packing device or a hammer and block.
   5. Wet surface lightly with water, then apply a slurry coat at a coverage of 1.5 lb./sq. yd. over the repaired area and to 6” strip on either side of slot.
   6. Cure by fog spraying periodically with water for two days.

3.04 SHALLOW CONCRETE SPALL:

A. General: This work consists of the removal of unsound concrete and the repair of spalled and delaminated concrete surfaces for an area of five square feet or less, and one inch or less in depth, unless otherwise indicated on the drawings.

B. Repair Procedure:

1. Inspection: Inspect concrete surfaces to be repaired under work of this section to determine the exact limits and locations of those areas to be repaired.
2. Make a one-inch-deep saw cut around the perimeter of the repair area. Remove spalled, scaled, loose, and deteriorated concrete to sound concrete. Use maximum 30 pound size pneumatic hammer or other approved method to remove deteriorated concrete. Thoroughly blast and vacuum the newly exposed area prior to installing repair mortar. Remove all debris from the site.

C. Minimum ambient and substrate temperature at time of application: 45º F and rising.

3.05 DEEP CONCRETE SPALL:

A. General Requirements: This consists of the removal of unsound concrete and the repair of spalled and delaminated concrete surfaces in areas greater than five (5) square feet and greater than one inch (1") deep, using repair mortar with pea gravel. Contact manufacturer for recommended amount of pea gravel.

B. Mixing:
1. Follow manufacturers' recommendations.

C. Repair Procedure:
1. Inspection: Inspect concrete surfaces intended to be repaired under work of this section to determine the exact limits and locations of those areas.
2. Make a one-inch deep saw cut around the perimeter of the repair area. Remove spalled, scaled, loose, and deteriorated concrete to sound concrete. Minimum depth of concrete removal shall be 4 inches. Thoroughly blast and vacuum the newly exposed area prior to forming. Remove all resulting debris from the site.
3. Remove unsound concrete material in a manner to facilitate uniform placement of fresh concrete; slope upper area of excavated voids evenly to within one inch (1") of the face of the concrete to preclude entrapping air and forming hollow spots in the freshly placed concrete. Within one inch (1") of the surface, the upper outline shall be essentially normal (perpendicular) to the surface.
4. Render all surfaces of exposed concrete and reinforcing steel free of oil, solvent, grease, dirt, dust, bitumen, rust, loose particles, and foreign matter.
5. If reinforcing steel is encountered, use caution where reinforcing steel is uncovered so as not to damage the steel or its bond in the surrounding concrete. Do not use pneumatic tools in direct contact with reinforcing steel. Use maximum 30 pound size hammer for chipping behind reinforcing steel. Exposed reinforcing shall remain in place except where otherwise indicated for removal by direction of the Engineer or the Contract Drawings. Blast reinforcing steel in accordance with SSPC-SP-6, Commercial Blast Cleaning, to remove all contaminants, rust and rust scale.

a. In areas where reinforcing steel is found to be surrounded by deteriorated concrete or has at least one-half its surface area exposed or has less than 1" cover, the depth of removal shall be such as to include all deteriorated concrete but not less than 3/4" below or behind the reinforcing steel.
b. Where the existing reinforcing steel is severely corroded or damaged, cut out reinforcing steel and replace with new reinforcing steel of the same size and spacing. Where existing steel is determined by the Engineer to have insufficient cover, either replace reinforcing or adjust as directed. Attach new steel behind existing steel with a minimum lap of 16". Remove concrete to a minimum depth of 3/4" behind the new steel.

6. Provide Bonding compound on excavated surfaces.

3.06 INJECTION STRUCTURAL REPAIR CONCRETE CRACKS/JOINTS

A. General Requirements: This consists of the structural repair of cracked concrete including interior slabs, exterior above-grade slabs, and structures exposed to foot and pneumatic tire traffic.
1. Crack must be clean, sound, less than 1/4" wide, and free of surface moisture. Remove all disintegrated and loose materials by mechanical means including shotblasting, sandblasting, low pressure water cleaning, or high pressure water jetting. Areas cleaned with water methods must be allowed to dry for a minimum of 24 hours at room temperature (about 73°F).
2. Mixing and Injection:
a. Follow manufacturer's recommendations for installation.

3.07 GRAVITY REPAIR CONCRETE CRACKS

A. General: This work consists of gravity repair of horizontal cracks as indicated on the drawings.
1. Crack must be clean.
2. Seal underside of slab surface prior to filling if cracks reflect through structural slab.
3. Provide temporary dam each side of crack and fill the crack with epoxy. Remove temporary dam when epoxy hardens and remove any harden epoxy on top surface.
4. Follow manufacturer's recommendations for application.

3.08 FULL DEPTH CONCRETE SPALL (CAST-IN-PLACE CONCRETE):

A. General Requirements: This consists of the removal of unsound concrete and the repair of spalled and delaminated concrete surfaces in areas as noted on drawings, using cast-in-place concrete.

B. Mixing:

1. Follow manufacturers' recommendations.
2. ACI 301-10.

C. Repair Procedure:
   1. Inspection: Inspect concrete surfaces intended to be repaired under work of this section to determine the exact limits and locations of those areas.
   2. Make a one-inch deep saw cut (or as noted on drawings) around the perimeter of the repair area. Remove spalled, scaled, loose, and deteriorated concrete to sound concrete. Thoroughly blast and vacuum the newly exposed area prior to forming. Remove all resulting debris from the site.
   3. Remove unsound concrete material in a manner to facilitate uniform placement of fresh concrete; slope upper area of excavated voids evenly to within one inch (1") of the face of the concrete to preclude entrapping air and forming hollow spots in the freshly placed concrete. Within one inch (1") of the surface, the upper outline shall be essentially normal (perpendicular) to the surface.
   4. Render all surfaces of exposed concrete and reinforcing steel free of oil, solvent, grease, dirt, dust, bitumen, rust, loose particles, and foreign matter.
   5. Use caution where reinforcing steel is uncovered so as not to damage the steel. Do not use pneumatic tools in direct contact with reinforcing steel. Use maximum 30 pound size hammer for chipping behind reinforcing steel. Exposed reinforcing shall remain in place except where otherwise indicated for removal by direction of the Engineer or the Contract Drawings. Blast reinforcing steel in accordance with SSPC-SP-6, Commercial Blast Cleaning, to remove all contaminants, rust and rust scale.
      a. In areas where reinforcing steel is found to be surrounded by deteriorated concrete or has at least one-half its surface area exposed or has less than 1" cover, the depth of removal shall be such as to include all deteriorated concrete but not less than 3/4" below or behind the reinforcing steel.
      b. Where the existing reinforcing steel is severely corroded or damaged, cut out reinforcing steel and replace with new reinforcing steel of the same size and spacing. Where existing steel is determined by the Engineer to have insufficient cover, either replace reinforcing or adjust as directed. Attach new steel behind existing steel with a minimum lap of 16". Remove concrete to a minimum depth of 3/4" behind the new steel.
   6. Place new reinforcing bars per drawings. Drill and grout into existing concrete using epoxy adhesive.
   7. Form excavated areas on vertical surfaces of concrete members in accordance with the requirements of ACI 301-10. Design forms so that placement access will be at the top of each formwork assembly.
      a. Prior to forming up vertical surfaces, install reinforcement as indicated on the Contract Drawings or as required and directed by the Engineer.
   8. Provide Bonding compound on excavated surfaces.

END OF SECTION

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SECTION 04050

COMMON WORK RESULTS FOR MASONRY

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies furnishing mortar, grout, and accessories for masonry work, including brick masonry, concrete unit masonry, granite and other stone masonry. The installation of such material is specified in the various masonry sections.

1.02 RELATED SECTIONS

A. Section 04220 - Concrete Unit Masonry

B. Section 05500 - Metal Fabrications

C. Section 07620 - Sheet Metal Flashing and Trim

1.03 SUBMITTALS

A. Submit the following for approval in accordance with the General Provisions and with the additional requirements as specified for each:
   1. Shop Drawings:
      a. Manufacturer's data: Recommendations for use of materials, preparation of substrate, limitations and special instructions for materials necessary to the work.
   2. Samples:
      a. Three of each type of the following products used in the work:
         1) Mortars: Cured samples showing color of each type.
         2) Accessories: Representative samples of each type.
         3) Certification.

1.04 QUALITY ASSURANCE

A. Codes, Regulations, Reference Standards and Specifications:
   1. Comply with codes and regulations of the jurisdictional authorities.
   2. ASTM: A36, A82, A153, A276, A666, A775, C114, C144, C150, C207, C270, C476, C665, C780, C881, C1019, D570, D638, D695, D1525, D2000, D2240, F593, F594.
   3. FS: HH-I-521.

B. Source Quality Control:

1. Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver products to job site in their original unopened containers clearly labeled with manufacturer's name and brand designation, referenced specification number, type and class as applicable.

B. Store products so as to prevent water intrusion, dampness and deterioration. Store loose materials sand and aggregates so as to prevent intrusion of foreign materials.

C. Handle products so as to prevent breakage of containers and damage to products.

1.06 JOB CONDITIONS

A. Environmental Requirements:
   1. Do not use materials or aggregates that are covered with frost. Do not mix mortar when the temperature is below that specified for masonry work.
   2. Provide protective covering and heat as specified for masonry work.
   3. Perform work under environmental conditions consistent with manufacturer's recommendations for materials being used in the work.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT MATERIALS

A. Cement:
   1. ASTM C150, Type I, Portland cement, packaged in one-cubic-foot waterproof bags.
      a. For exterior walls, use low alkali cement; maximum 0.60 percent total alkali when tested according to ASTM C114.
      b. For below grade use type II cement and lime.
   2. Cement for brick masonry:
      a. Factory-prepared, color-blended with nonstaining, inorganic coloring pigment.
      b. Pigments not to exceed 10 percent of weight of cement.
      c. Pigment blended in such quantity to produce cured mortar color matching face brick when mixed with hydrated lime and fine aggregate.

B. Hydrated Lime:
   1. ASTM C207, Type S.
   2. Uniform color for similar work.

C. Fine Aggregate: Clean, sharp, masonry sand, ASTM C144. For joints less than 1/4 inch, grade aggregate with 100 percent passing the Number 16 sieve.

D. Water: Potable.

E. Pigment: As necessary to produce colored mortar matching color of brick unless otherwise indicated.

F. Admixtures: Do not add admixtures including air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

G. Epoxy for Epoxy Mortar: Two-component, ASTM C881, Type 3, Grade 3, Class C, with the following additional requirements:
   1. Component A: Modified-epoxy resin of epichlorohydrin bisphenol A-type, containing suitable viscosity control agents and having epoxide equivalent of 180-200.
   2. Component B: Primarily reaction product of aromatic amine and an aliphatic amine with epoxy resin of epichlorohydrin bisphenol A-type.
   3. Ratio of Component A to Component B: By volume, 1:2.
   4. Properties of mixed components:
      a. Solids content: 100 percent by weight.
      b. Pot life: 20 to 30 minutes at 73F.
      c. Tack-free time, thin film: Two to four hours at 73F.
      d. Final cure, 75-percent ultimate strength, ASTM D695: Two days at 73F.
      e. Initial viscosity, A plus B: 250 to 350 cps at 73F.
   5. Properties of cured material:
      a. Tensile strength, ASTM D638: 5,000-psi minimum at 14 days, 73F cure.
      b. Tensile elongation, ASTM D638 modified: One to three percent at 14 days, 73F cure.
      c. Compressive strength, ASTM D695: 10,500-psi minimum at 28 days, 73F cure.
      d. Water absorption, ASTM D570: One-percent maximum.
      e. Bond strength: 2,000-psi minimum at 14 days.
      f. Hardened to hardened: 73 degrees Fahrenheit cure.
      g. Vicat softening temperature, ASTM D1525: 121F minimum.

H. Aggregate for Epoxy Mortar: Silica sand, Size 20 to Size 40, dust-free and moisture-free.

2.02 MORTAR AND GROUT MIXES

A. Mortar Mixes for Brick Masonry: ASTM C270, types as follows:
   1. Type S: For exterior loadbearing masonry and for masonry in contact with earth, proportioned by volume as follows:
      a. Portland cement: One part.
      b. Hydrated lime: 1/4 to 1/2 part.
      c. Fine aggregate: Not less than 2-1/2 nor more than three times sum of volumes of cement and lime.

d. Pigment: As necessary to produce colored mortar matching color of brick unless otherwise indicated.

2. Type N: For interior non loadbearing masonry, proportioned by volume as specified for Type S, except 1/2 to 1-1/4 parts hydrated lime.
3. Color: As shown or as selected by the AR.
4. Mortar Mixes for Concrete Unit Masonry: As specified for brick masonry, except pigment not required.

B. Grout: For setting steel lintels and similar items, grouting mortar composed of one-part Portland cement and two parts fine aggregate with sufficient lime putty added to obtain quick set.

C. Preshrunk Mortar: Dry, premixed, ready-to-use formulation.

2.03 ACCESSORIES

A. Continuous joint reinforcement:
1. Accessories for Brick and Concrete Unit Masonry:
a. Prefabricated continuous-reinforcing tie system fabricated of wire conforming to ASTM A82. Flush-welded cross ties, nine-gauge wire, hot-dip galvanized after fabrication in accordance with ASTM A153, Class B2, 1.50 ounces for side and cross rods.
b. Fabricate joint reinforcement in straight lengths of not less than 10 feet of truss design with continuous diagonal cross ties spaced maximum 16 inches o.c.
1) Make width of unit 1-1/2 inches to two inches less than thickness of wall.
2) For multi-wythe wall, provide one side rod for each face shell of masonry more than four inches in width; plus one side rod for each wythe of masonry four inches or less in width.
3) At cavity walls, provide integral drips on cross rods. Where horizontal joints of outer wythe does not align with back-up joints, provide adjustable two-piece tab design to engage the outer wythe by at least 1-1/2 inches.
a) Corner reinforcement: Prefabricated, shop-welded corner-L and intersection-T units matching the continuous wall units.
b) Spacing: See related work sections.
2. Dovetail anchors:
a. Flexible, adjustable or corrugated 1-inch wide dovetail anchors of 12 gauge galvanized steel. Place anchors every 16 inches in height of wall at intersections of masonry walls and concrete, and for masonry furring of concrete.
3. Wall plugs:
a. Galvanized 26-gauge corrugated metal, approximately three inches long and of standard manufacture, where necessary for attaching other work.
4. Z-type rigid-steel anchors: Steel, ASTM A36, 1/4-inch thick by 1-1/2 inches wide by 28 inches long, galvanized; with one two-inch opposing 90-degree bend at each end.

5. Corrugated-steel anchors:
   a. 12 gauge by 2 inches by 5 inches with one 1 ½ inches 90-degree: #345 galvanized corrugated Buck Anchor by Simpson-tie or approved equal.
6. Steel framing anchors:
   a. Fabricated of 3/16-inch galvanized wire tie and galvanized flat-steel strap one-inch wide by 22 gauge or 3/4-inch wide by 12 gauge.
7. Weep-hole tubes:
   a. 3/8-inch OD, medium density, nonstaining, polyethylene tubes of lengths ensuring complete panel penetration and unobstructed flow. Fire-resistant compressible filler: Inorganic, non-asbestos mineral fiber safing insulation, with foil facing to impede smoke passage; moisture resistant, mildew-proof and vermin-proof, noncorrosive and non-deteriorating; UL-listed; meeting ASTM C665 and FS HH-I-521 Type III, except for identification marking.
8. Control joint gasket:
   a. Solid styrene-butadiene-rubber compound per ASTM D2000, 2AA-805, factory extruded into shapes for use with standard sashblock to provide stability to masonry walls at expansion and control joints; minimum shear strength 540 psi, durometer hardness 80 (plus or minus 5) per ASTM D2240. Provide T-shape and X-shape for vertical joints as appropriate, flat shape beneath load-relieving angles.
9. Cavity Drainage System:
   a. 1 inch thick by 10 inches high by 5 feet long section of high density polyethylene or nylon mesh designed to allow moisture to flow downward in cavity joint.
10. Masonry Cell Insulation:
    a. Molded polystyrene Insulation Units - Rigid, cellular thermal insulation formed by the expansion of polystyrene - resin beads or granules in a closed mold to comply with ASTM 578, Type I. Provide specially shaped units designed for installing in cores of masonry units.

B. Steel lintels: Section 05500.

C. Masonry lintels: Section 04220.

D. Flashing: Section 07620.

PART 3 EXECUTION

3.01 MIXING OF MORTAR

A. Mix mortar materials in an approved clean mechanical mixer for at least three minutes and not more than five minutes with a minimum amount of water to produce workable consistency.

B. Mortar which has stiffened because of evaporation of water may be re-tempered by adding water as needed to restore necessary consistency. Use mortar within 2-1/2 hours of initial mixing.

C. Use an approved method of measuring materials and mortar that will control and accurately maintain specified proportions throughout the work. Shovel measure is prohibited. Measure sand in damp, loose condition.

D. Apply pre-shrunk mortar in accordance with the manufacturer's instructions.

E. For alteration and restoration work, tint or modify mix to match mortar of existing masonry.

F. The AR may direct a test of the mortar in accordance with ASTM C780 and a test of the grout for compressive strength per ASTM C1019 to establish compliance with specified requirements.

END OF SECTION

SECTION 04220

CONCRETE UNIT MASONRY

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies providing concrete unit masonry and glazed concrete masonry.

1.02 RELATED SECTIONS

A. Section 04050 - Common Work Results for Masonry

B. Section 05500 - Metal Fabrications

C. Section 07920 - Joint Sealants

1.03 SUBMITTALS

A. Submit the following for approval in accordance with the General Requirements and with the additional requirements as specified for each:
   1. Samples for Initial Selection: Samples in small-scale form showing the full range of colors and textures available for each different exposed masonry unit required.
   2. Samples:
      a. Three sets of each type of the following products used in the work.
         1) Concrete masonry units (CMU):
            a) Lightweight.
            b) Normal weight.
            c) Special shapes.
            d) Glazed.
         2) Precast lintels.
         3) CMU lintels.
      b. Concrete masonry panels:
         1) Construct sample panels for exposed work only. Build panels not less than four feet square by eight inches thick, incorporating reinforcement and concrete masonry units. Construct one panel of concrete glazed and unglazed masonry units.
         2) Use types of material, color variation, mortar, bond, tooling of joints, method of laying and workmanship shown or specified.
         3) Maintain panels in good condition and protect from moisture penetration until completion of masonry work and removal is directed.

4) Approval of mock ups is for color, texture and blending of masonry unit; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
5) Maintain panel in good condition and protect from moisture penetration until completion of masonry work. Panel may remain as part of finished work after approval.

3. Shop Drawings: Show fabrication and installation details for the following:
   a. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
   b. Certification.

1.04 QUALITY ASSURANCE

A. Codes, Regulations, Reference Standards and Specifications:
   1. Comply with codes and regulations of the jurisdictional authorities.
   2. NCMA: TEK Manual for Concrete Masonry Design and Construction.
   3. ASTM: A615, C33, C55, C90, C129, C150, C744, E119.
   4. ACI: 315, 530.1-99.
   5. UL: Fire Resistance Directory.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

C. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver products to jobsite in good condition.

B. Keep products clean and dry. Prevent contact with soil.

C. Handle products so as to prevent chipping and breakage.

1.06 JOB CONDITIONS

A. Environmental Requirements:
   1. The following are prohibited:
      a. Use of products that are covered with frost.
      b. Erection of masonry when the temperature is below 40F or tending to fall below 40F, unless suitable fireproof protection covering and heat are provided to maintain work and materials above 40F.

PART 2 PRODUCTS

2.01 MATERIALS

A. CMU:
   1. General:
      a. Nominal dimensions:
         1) Face size: 7-5/8 inches by 15-5/8 inches.
         2) Thickness: As shown.
      b. For exposed work, units of uniform medium texture, free from defects and of uniform dimensions. Furnish special units as necessary.
      c. Units having UL Fire Resistance Directory ratings to achieve fire ratings for walls as required by local building codes and as shown.
      d. Units free from iron and other substances that will stain plaster or paint.
   2. Lightweight CMU:
      a. Hollow, lightweight loadbearing concrete units: ASTM C90, Type I.
      b. Solid, lightweight loadbearing concrete units: ASTM C90, Type I.
      c. Lightweight concrete brick: ASTM C55, Type I, Grade N.
      d. Aggregate: Limited to expanded shale or slate.
      e. Hollow, light-weight non-load bearing concrete units: ASTM C129, Type 1
   3. Normal-weight CMU:
      a. Solid loadbearing units: ASTM C90, Type I.
      b. Exposed alteration and restoration work: Units of same type, grade, size, color variation, texture and appearance as existing masonry work.
   4. Concrete fill for CMU bond beams and reinforced masonry unit cores: Class 3500; maximum aggregate size, 3/4 inch, and in accordance with ACI 301-10.

B. Mortar, Grout and Masonry Accessories: Section 04050 - Common Work Results for Masonry.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean foreign substances which would affect bond of mortar from surfaces to receive CMU.

B. Built-In Work.
   1. Verify locations of chases and openings for pipes, conduits and ducts.
   2. Establish locations for walls and partitions; verify that door frames and other built-in work provided by others are or can be properly located.

3.02 ERECTION

A. Erect exposed CMU masonry work to conform to approved sample panel.

B. Use of loadbearing and non-loadbearing units shall be governed by locations and purposes to be served. Except as otherwise shown, follow these general uses:
   1. Loadbearing: Backup loadbearing masonry walls and for bearing partitions.
   2. Non-loadbearing: Furring, non-bearing partitions and backup non-loadbearing masonry walls.
   3. Solid: Where specifically required by drawings, for fireproofing structural steel and for partitions with fire ratings.

C. Erect adjoining walls simultaneously. Do not erect walls more than five feet above adjoining walls. Toothing is prohibited. Cover and protect the tops of unfinished walls.

D. Plumb piers, walls and partitions. Level courses using uniform joint thickness for interior work, build external corners with bullnose units.

E. Place reinforcement and build in openings for pipes, conduits, ducts, chases, frames and other work as shown.

F. Grout in accordance with Section 04050 and set in place miscellaneous steel lintels furnished by other trades for openings in masonry walls in accordance with Section 05500. Provide eight-inch minimum bearing on adjacent masonry unless otherwise indicated.

G. As the work progresses, keep masonry clean by stiff brushing with fiber brush. Do not wet units before laying up. Unless otherwise shown, lay units in running bond.
   1. Set cored units with cells vertical, unless manufactured with horizontal cores. Open ends not permitted.
   2. Lay out so that at jambs and internal and external angles, the headers in alternate courses are at least 2 inches long. Use “Z shapes if necessary, especially with glazed masonry units.
   3. Lay units out so that no cut piece is less than 5 inches long; not less than 2 inches high
   4. Lay concrete units up suitable for painting. See finish schedules.

H. Prevent smearing mortar on surface of exposed units. If mortar smears occur, remove while soft.

I. Carefully cut faces of units for electrical or other outlets and cut-out backs for conduit and other piping. Where possible, use full-size units. Do not use portions of units shorter than four inches. Perform cutting with power-driven masonry saws.

J. Build partitions straight, plumb, true to line and uniform in thickness unless shown otherwise. Anchor partitions at junctions with CMU exterior walls using Z-type steel

anchors, rigid or corrugated, Z-bar anchors vertically 24 inches on center maximum unless otherwise shown. Use dovetail anchors spaced not over 16 inches on vertical centers where partitions abut concrete walls or concrete columns and steel framing anchors where partitions abut steel columns. Start partitions on concrete slabs and extend to structure above, except where shown to be erected only to ceiling.

K. Use CMU or precast lintels except where steel lintels are shown. Use precast lintels for four-inch CMU partitions. For other CMU partitions and walls, use lintels fabricated at plant or at jobsite from concrete-masonry lintel units. Provide eight-inch minimum bearing on adjacent masonry unless otherwise indicated.

L. Fill cells of CMU with mortar in accordance with Section 04050, adjacent to openings and around built-in and embedded items.

M. Place prefabricated continuous joint reinforcement in alternate horizontal joints above grade and each horizontal joint below grade. Terminate each side of expansion joints. Use specially fabricated sections at corners and intersections.

N. Fill cells solid with grout in accordance with Section 04050 where vertical reinforcement is installed within CMU walls.

O. Fill heads and jambs of hollow metal frames solid with mortar in accordance with Section 04050, as laying of units progresses.

P. Tooling joints:
   1. After mortar has attained initial set, finish and compact with non-staining metal jointing tool, forcing mortar tight against masonry units and closing all hair line cracks and crevices.
   2. All interior and exterior joints tooled concave type, except as stated below or noted otherwise.
      a. At wall faces to receive other facing materials having mortar backing, strike joints flush.
      b. At concealed joints and joints on cavity side of cavity walls, strike flush.

Q. Mortar Bedding in accordance with Section 04050:
   1. Hollow units shall be laid with full mortar coverage on horizontal and vertical face shells, except that webs shall also be bedded in all courses of piers, columns, and pilasters, and in the starting course of footings and solid foundation walls, and where adjacent to cells or cavities to be reinforced and/or filled with mortar or grout.
   2. Solid units laid with full head and bed joints.
   3. Masonry units:
      a. Laid in beds of mortar of such plasticity and fullness and spread with trowel so that pressing and shoving units will obviate dashing or slushing joints after units are laid. Mortar shall not be “furrowed”.
      b. In cavity walls, mortar shall be beveled on cavity side to prevent protruding mortar fins and subsequent dropping of mortar into cavity.

c. For interior and exterior faces of walls, prior to placing units, one end of each stretcher shall be fully covered with mortar.
d. For any wall thickness, leave no voids whatever, except space in cavity walls.

R. Top of Non-Loadbearing Partitions: Build non-loadbearing interior partitions full height of story to underside of solid floor or roof structure above, unless shown otherwise. Build as follows depending on the movement requirements of floor or structure above, and as shown:
1. Install fire resistant compressible filler in joint between top of partition and underside of structure above.
2. Fill top joint with mortar in accordance with Section 04050, after dead-load deflection of structure above approaches final position.

S. Installation of Masonry Accessories:
1. Wall anchors:
a. Space Z-type rigid-steel anchors at intersections of loadbearing CMU walls and control joints.
b. Space corrugated-steel anchors 16 inches on centers vertically at control joints located not more than two feet from intersections of CMU walls.
2. Steel framing anchors:
a. Install anchors to attach CMU walls to structural steel building frame at 16 inches on centers horizontally and vertically. Weld anchors to structural steel so as to achieve full strength of anchor system.
3. Soldier-course anchors:
a. Install corrugated-steel anchors in horizontal mortar joints of soldier coursing, except where continuous wall reinforcement is used. Space anchors 24 inches on centers horizontally.
4. Flashing:
a. Install flashing to provide positive keying to mortar.
5. Weep holes:
a. Install at two feet on centers at terminations of through-wall flashing, base flashings, lintels, or relief angles, and as shown.
6. Control joint gasket:
a. Install in sash-type CMU and between wythes in accordance with manufacturer's instructions and as shown. Seal weather side of control joints with sealant and backup rod as specified in Section 07920.

3.03 POINTING AND CLEANING

A. Pointing:
1. When approved, point holes in joints of exposed CMU masonry surfaces by completely filling with preshrunk mortar.
2. Point exposed raked joints of CMU masonry with mortar and tool to match approved samples panels.

B. Cleaning:

1. After pointing, wet and clean exposed CMU masonry surfaces with soap-and-water solution, applied with stiff-fiber brushes leaving masonry clean, free of mortar daubs and with tight mortar joints throughout. The use of acid is prohibited.
2. Allow masonry walls to cure at least three weeks in summer and five weeks in winter before cleaning.
3. Begin cleaning at top and work down.
4. Remove as much mortar from masonry as is possible by hand with wooden paddles and nonmetallic scraper hoes or chisels or stiff bristle brushes taking care not to deface masonry units.
5. Remove specific stains by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain present on exposed surfaces.
6. Clean surfaces thoroughly and carefully with specified cleaning solution.
7. Rinse and flush with clean water immediately after cleaning.
8. Leave work in clean condition, free from mortar stain or other defacement.

END OF SECTION

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SECTION 05010

MAINTENANCE OF METALS

PART 1 GENERAL

1.01 SUMMARY

A. The work shall consist of providing the necessary labor, materials, equipment and supervision for the repair of welded connections as shown in the Contract Drawings.

1.02 RELATED SECTIONS:

A. Section 01550 – Access Roads, Parking Areas and Parking Controls

B. Section 01560 – Temporary Barriers and Closures

C. Section 05500 – Metal Fabrications

D. Section 09970 – Special Coatings for Steel

1.03 SUBMITTALS

A. Mill Certificates: Signed by manufacturers certifying that products furnished comply with requirements.

B. Welding Certificates: Copies of certificates for welding procedures and personnel.

C. Qualification Data: Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in welding connections similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to perform the required work.

B. Welding Standards: Qualify procedures and personnel according to the following:
   1. AWS D1.1, “Structural Welding Code – Steel”
   2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and holds a current certification. Provide copies of welder certifications.

1.05 DELIVERY STORAGE AND HANDLING

A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification.

C. Keep steel members off ground by using pallets, platforms, or other supports.

D. Protect steel members and packaged materials from corrosion and deterioration.

E. Store fasteners in a protected place. Clean and lubricate bolts and nuts that have become dry or rusty before use.

F. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed by the AR.

1.06 SEQUENCING

A. Field Measurements:
   1. Where connections are indicated to fit to existing and other construction, verify all dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Job Conditions:
   1. Contractor shall perform all work while maintaining vehicular parking to site and within site that are not under construction in accordance with Section 01550 and Contract Drawings.
   2. Contractor shall provide adequate signalization in accordance with Section 01560 and Contract Drawings.

PART 2 PRODUCTS

2.01 FERROUS METALS

A. Steel plates, Structural Shapes, Shim Plates and Bars. ASTM A36.

B. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy to be welded.

C. Prime / Paint: Field primer and paint shall conform to the requirements listed in Section 09970.

PART 3 EXECUTION

3.01 PREPARATION

A. Provide temporary shores, guys, braces, and other supports to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary shoring after repairs are approved by the Quality Control Engineer.

B. Clean and sand blast all surfaces to be welded. Remove loose rust, mill scale, slag, dirt, dust, and other debris.

C. Check existing connections for failed welds, corrosion, section loos of plates, or other defects and report findings to the Quality Control Engineer.

D. Utilize existing weld plates where possible. Replace plates if section loss exceeds 25% or if directed by the Quality Control Engineer. Replace weld plates in accordance with Section 05500.

E. Grind base metal surfaces to remove corrosion, coatings or debris prior to welding. Weld immediately thereafter.

3.02 FIELD WELDING

A. Comply with AWS code for procedures of manual shield metal – arc welding, appearance and quality of welds made, method used in correction welding work, and the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Grind smooth exposed fillet welds Y2 inch and larger. Grind flush butt welds. Dress exposed welds.
   4. Remove welding flux immediately. All field welds shall be inspected and tested in accordance with AWS D1.1.
   5. Clean and prime all field welds in accordance with Section 09970.
   6. Fill all weld pockets with polyurethane sealant in accordance with Section 07920.

3.03 QUALITY ASSURANCE COMPLIANCE

A. The Contractor shall prepare a contract quality assurance program based on the requirements for work plans, submittals and other quality assurance and quality control articles contained in this Contract. The program shall consist of the plans, procedures and organization necessary to provide inspection, testing (unless otherwise specified), and verification that materials, equipment, workmanship, fabrication, construction and operations comply with the Contract requirements. The Quality Assurance Program, and the name and qualifications of the person within the Contractor's organization responsible for managing the approved Quality Assurance Program, shall be submitted to the AR. Work will not be permitted nor will progress

payments made, until the Contractor's Quality Assurance Program and Quality Assurance Manager are approved for that portion of work by the AR.

B. To assure the Contractor compliance with and conformance to the approved Contractor's Quality Assurance Program, the program will be subject to quality audits. Audits will be scheduled by the AR as required.

C. Inspections: Contractor will engage an independent Certified Welding Inspector (CWI) to perform field inspections and tests and prepare tests reports. CWI will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements. Deficiencies noted in inspections and test report; which do not comply with specified requirements will be corrected at the Contractor's expense. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

D. Visually inspect field-welded connections. In addition to visual inspections, field-welded connections may be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option:

E. Magnetic Particle Inspection: ASTM E 709
1. Magnetic Particle inspection: ASTM E 709, performed on root pass and on finished weld. Cracks or zones with incomplete fusion or penetration will be accepted.
2. 7. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T".
3. Ultrasonic Inspection: ASTM E 164.

3.04 CLEANING

A. Remove all debris from the site.

END OF SECTION

SECTION 05100

STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SUMMARY

A. This work shall consist of furnishing all labor, materials, equipment and incidentals necessary for repairs to existing structural steel or installation of new structural steel as directed by the AR in the field. The work shall also include the furnishing, installing, maintaining and removing any shoring, as required, related to the work specified above.

1.02 RELATED WORK:

A. Section 09970 – Special Coatings for Steel

B. Section 02250 – Shoring

1.03 REFERENCES

A. American Institute of Steel Construction:

B. AISC 360 - Specification for Structural Steel Buildings.

C. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
4. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
6. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
7. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
8. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
9. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
10. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
11. ASTM A992/A992M - Standard Specification for Structural Steel Shapes.

12. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
13. ASTM E164 - Standard Practice for Ultrasonic Contact Examination of Weld elements.
14. ASTM F436 - Standard Specification for Hardened Steel Washers.
15. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

D. American Welding Society:
1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
2. AWS D1.1 - Structural Welding Code - Steel.

E. SSPC: The Society for Protective Coatings:
1. SSPC SP 3 - Power Tool Cleaning.
2. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

1.04 SUBMITTALS

A. Submit in accordance with General Provisions for Construction and details shown on the drawings and the specifications.

B. Shop Drawings:
1. Submit shop drawings for shoring system, if required, which clearly indicate profiles, sizes spacing and locations of shoring members, connections, attachments, anchorages, framed openings, size and type of fasteners, cambers, and clearances.
2. Indicate profiles, sizes, spacing, and location of structural members, openings, attachments, and fasteners.
3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
4. Identify all bolted connection locations with the type, number and size of bolts and the connection type.

C. Erection Procedure: Submit description data to illustrate the installation procedure of structural steel work. Obtain field measurements where necessary for fabrication and installation of the work. Exact measurements are the Contractor's responsibility.

D. Mill Test Reports: Submit indicating structural strength, destructive and non-destructive test analysis.

E. Welders Certificates: Submit for welders employed on the Work, verifying AWS qualification within previous 12 months.

F. Welding Procedure: Submit written description as required to illustrate each welding procedure to be performed in the specified work.

1.05 QUALITY ASSURANCE

A. Welder Qualifications: Welding shall be done only by currently certified welding operators qualified according to AWS D1.1.

B. Testing Agency: Testing and inspection shall be made as required, by an approved testing laboratory selected and paid by the Owner. Contractor shall furnish testing agency access to work, facilities and incidental labor required for testing and inspection. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

C. Codes and Standards: Comply with the provisions of the following except as otherwise indicated:

1. AISC "Code of Standard Practice for Steel Building and Bridges".
2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings".
3. AWS D1.1 "Structural Welding Code".
4. Appropriate specifications of the American Society for Testing and Materials.

D. The work in this section should comply with all applicable provisions of the state and local building and safety codes and any other codes referenced therein.

E. Any material or operation specified by reference to the published specification of a manufacturer shall comply with the requirements of the latest edition of the standards listed herein. In case of conflict between the referenced specification and the project specifications, the project specifications shall govern.

1.06 QUALIFICATIONS

A. Fabricator: Company specializing in performing Work of this section shall have minimum three years documented experience with the following current AISC Certification:
1. Standard Steel Building Structures (STD).

B. Erector: Company specializing in performing Work of this section shall have minimum three years documented experience with the following current AISC Certification:
1. Certified Steel Erector (CSE).

C. Shop Painter: Company specializing in performing Work of this section shall have minimum three years documented experience.

D. Welders and Welding Procedures: AWS D.1 qualified within previous 12 months.

1.07 SEQUENCING

A. Field Measurements - Verify all dimensions of other construction by field measurements before and after fabrication to ensure proper fit. Report discrepancies in existing construction to AR. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 PRODUCTS

2.01 STRUCTURAL STEEL

A. Structural W-Shapes: ASTM A992/A992M.

B. Structural M-Shapes: ASTM A36/A36M.

C. Structural S-Shapes: ASTM A36/A36M.

D. Structural T-Shapes: Cut from structural W-shapes, M-shapes, or S-shapes.

E. Channels and Angles: ASTM A36/A36M.

F. Round Hollow Structural Sections: ASTM A500, Grade B.

G. Square and Rectangular Hollow Structural Sections: ASTM A500, Grade B.

H. Structural Pipe: ASTM A53/A53M, Grade B.

I. Structural Plates and Bars: ASTM A36/A36M.

J. Floor Plates: ASTM A786/A786M; diamond raised pattern.

2.02 FASTENERS, CONNECTORS, AND ANCHORS

A. High Strength Bolts: ASTM A325; Type 1 or ASTM A490; Type 1.
   1. Finish: Hot dipped galvanized, unless otherwise indicated.

B. Nuts: ASTM A563 heavy hex type.
   1. Finish: Hot dipped galvanized, unless otherwise indicated.

C. Washers: ASTM F436; Type 1, circular. Furnish clipped washers where space limitations require.
   1. Finish: Hot dipped galvanized, unless otherwise indicated.

D. Anchor Rods: ASTM F1554; Grade 55, weldable.
   1. Shape: As indicated on Drawings.
   2. Plate Washers: ASTM A36/A36M.

3. Stainless steel threaded rods furnished with chamfered ends so that either end will accept a nut and washer. Anchor rods shall be manufactured to meet the requirements of ASTM F593.
4. Anchor rod epoxy: Two-component manufactured for anchoring stainless steel anchor rods to hardened concrete conforming to ASTM C881, Type IV, Grade 3, Class A, B, or C. Get time requirements of ASTM C881 waived. Embedment depth shall be sufficient to develop the ultimate shear strength of the rod embedded based on the manufacturer's test data for an assumed existing concrete compressive strength of 4,000 psi. Embedment lengths may be interpolated between concrete compressive strengths if approved by the manufacturer.

E. Threaded Rods: ASTM A36/A36M.
1. Finish: Hot dipped galvanized, unless otherwise indicated.

F. Forged Structural Steel Hardware:
1. Clevises and Turnbuckles: ASTM A108; Grade 1085.
2. Eye Nuts and Eye Bolts: ASTM A108; Grade 1030.
3. Sleeve Nuts: ASTM A108; Grade 1018.
4. Rod Ends, Yoke Ends and Pins, Cotter Pins, and Coupling Nuts: Carbon steel.

G. Expansion Anchors shall be Hilti Kwik Bolts as manufactured by HILTI , P.O. Box 21148, Tulsa, OK 74121 TEL. (918) 252-6000.

2.03 WELDING MATERIALS

A. Welding Materials: AWS D1.1; type required for materials being welded.

2.04 ACCESSORIES

A. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing minimum compressive strength of 7,000 psi at 28 days.

B. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20.

2.05 FABRICATION

A. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

B. Fabricate connections for bolt, nut, and washer connectors.

C. Develop required camber for members.

2.06 FINISH

A. Prepare structural component surfaces in accordance with SSPC SP 3.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted. Primer/Paint: Shop applied primer and field painting shall conform to the requirements listed in Section 09970.

C. Galvanizing for Structural Steel Members: ASTM A123/A123M; minimum 1.2 oz./sq. ft. coating thickness; galvanize after fabrication.

D. Galvanizing for Fasteners, Connectors, and Anchors:
   1. Hot-Dipped Galvanizing: ASTM A153/A153M.
   2. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

2.07 SOURCE QUALITY CONTROL AND TESTS

A. Shop test bolted and welded connections as specified for field quality control tests.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify bearing surfaces are at correct elevation.

C. Inspection: Exact measurements of the field dimensions for proper shop-fabrications are the Contractor's responsibility. Wherever the repair details shown on the drawings are not applicable, the Contractor shall identify the locations on the shop drawings and submit proposed details for an approval by the Consultant. Any changes of fabrication and/or installation of the support assembly from the approved details on the shop drawings submitted due to the Contractor's negligence of the detail inspection specified herein shall be the Contractor's responsibility. The cost of the above mentioned changes shall be borne by the Contractor with no extra cost to the Owner at all.

D. Provide temporary shoring in accordance with Section 02250.

E. Clean all surfaces where new connections are to be installed. Areas shall be free of all dirt dust and other debris.

F. Test fit pre-fabricated connection at the center of each double tee along the sliding side of the expansion joint prior to installation. Report any discrepancy to the Quality Control Engineer

3.02 FABRICATION

A. No work shall be fabricated or delivered prior to approval of the shop drawings.

B. Fabricate structural steel in compliance with the governing Building Code and the AISC "Code of Standard Practice", with modifications and additional requirements specified in this section. Where a conflict occurs between the standards specified above and the Building Code, the Building Code shall apply.

C. Fabricate and assemble structural assemblies as required in the shop to the greatest extent possible.

D. Properly mark and match-mark materials for field assembly.

3.03 SHOP WELDING

A. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

B. Obtain fusion without undercut or overlap.

C. Grind smooth exposed fillet welds 1/2 inch and larger. Grind flush butt welds. Dress exposed welds.

D. Remove welding flux immediately. All welds shall be inspected and tested in accordance with AWS D1.1.

3.04 ERECTION

A. Do not proceed with the work specified in this section until the shop drawings have been approved and any unsatisfactory conditions, if any, have been corrected in a manner acceptable to the Installation Contractor.

B. Furnish and install temporary shoring and bracing system as required and approved by the Consultant. Remove them as soon as the work specified in this Section has been finished.

C. Field connections: Bolted connections or other connections are indicated. Welded Construction shall comply with AWS Code.

D. High-Strength bolted construction shall be in accordance with AISC "Specifications for structural Joints using ASTM A-325 or A-490 Bolts."

3.05 FIELD QUALITY CONTROL

A. Materials and fabrication procedures are subject to inspection and tests, as required, in the mill, shop and field, conducted by the qualified and approved Testing

Laboratory. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

B. Correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with specified requirements. The cost of retests shall be borne by the Contractor.

C. All bolted connections that fail shall be corrected and retested. The cost of retesting of the connections shall be borne by the Contractor.
   1. Visually inspect epoxy adhesion of threaded rods into concrete. Do not remove existing connections until new connections are found acceptable and approved by the Quality Control Engineer.

D. All welds that fail shall be re-welded and retested until passing. The cost of all retesting shall be borne by the Contractor.
   1. Inspections: Contractor will engage an Independent Certified Welding Inspector (CWI) to perform weld inspections and tests and prepare test reports. CWI will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements. Deficiencies noted in inspections and test reports which do not comply with specified requirements will be corrected at the Contractor's expense. Additional testing, at Contractor's expense will be performed to determine compliance of corrected work with specified requirements.
   2. Visually inspect welded connections. In addition to visual inspection, welds may be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      c. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T".
      d. Ultrasonic Inspection: ASTM E 164.

3.06 CLEANING

A. Remove all debris and waste materials from the site

END OF SECTION

SECTION 05500
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel and/or metal items including but not limited to: bollards, brackets, hangers, pre-fabricated frames, anchors, outriggers, fasteners and touch up paint

1.02 RELATED SECTIONS

A. Section 06100 - Rough Carpentry

B. Section 08110 – Hollow Metal Doors and Frames

C. Section 08120 – Aluminum Doors and Frames

D. Section 09900 - Painting and Coating

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels ; 2005.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel ; 2008.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products ; 2009.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware ; 2009.

E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates ; 2003 (Reapproved 2007).

F. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength ; 2009a.

G. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric) ; 2009.

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process ; 2010.

I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength ; 2010

J. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings ; 2002 (Ed. 2004).

K. K. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings ; 1982 (Ed. 2004).

1.04 SUBMITTALS

A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections, profiles and miscellaneous shapes: ASTM A36/A36M.

B. Plates: ASTM A283.

C. Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1 , galvanized to ASTM A153/A153M where connecting galvanized components.

D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

E. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by intermittent welds and plastic filler.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FINISHES – STEEL

A. Prime paint all steel items.
   1. Exceptions: Galvanize items to be imbedded in masonry.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.04 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Perform field welding in accordance with AWS D1.1/D1.1M.

C. Obtain approval prior to site cutting or making adjustments not scheduled.

D. After erection, prime welds, abrasions , and surfaces not shop primed or galvanized , except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 06100
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roofing nailers.
B. Roofing cant strips.
C. Preservative treated wood materials.
D. Fire retardant treated wood materials.
E. Miscellaneous framing and sheathing.
F. Concealed wood blocking, nailers, and supports.

1.02 RELATED SECTIONS

A. Section 05500 - Metal Fabrications.
B. Section 07620 - Sheet Metal Flashing and Trim.
C. Section 07521 - Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware ; 2009.
B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials ; 2010b.
C. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood Protection Association ; 2010.
D. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce) ; 2005.
E. SPIB (GR) - Grading Rules; Southern Pine Inspection Bureau, Inc. ; 2002.

1.04 SUBMITTALS

A. Product Data: Provide technical data on wood preservative materials and application instructions.
B. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Douglas Fir-Larch, unless otherwise indicated.
   2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   3. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

C. Provide wood harvested within a 500 mile radius of the project site.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Southern Pine Inspection Bureau, Inc. (SPIB).

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
   3. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.04 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
1. Manufacturers:
2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
   a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
   b. Treat rough carpentry items as indicated .
   c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:
1. Manufacturers:
2. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft retention.
   a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
   b. Treat lumber exposed to weather.
   c. Treat lumber in contact with roofing, flashing, or waterproofing.
   d. Treat lumber in contact with masonry or concrete.
   e. Treat lumber less than 18 inches above grade.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors

and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.03 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at all roof openings except where specifically indicated otherwise. Form corners by alternating lapping side members.

3.04 CLEANING

A. Waste Disposal:
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 07015
PREPARATION FOR RE-ROOFING

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Section 07521 – Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing

1.02 REFERENCE STANDARDS

A. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board; 2008a.

1.03 QUALITY ASSURANCE

A. Contractor performing roof removal work shall demonstrate a minimum of 5 years' experience in performing similar work.

1.04 FIELD CONDITIONS

A. Do not remove existing roofing membrane when weather conditions threaten the integrity of the building contents or intended continued occupancy.

B. Maintain continuous temporary protection prior to and during installation of new roofing system.

PART 2 PRODUCTS

2.01 MATERIALS

A. Temporary Protection: Sheet polyethylene; provide weights to retain sheeting in position.

PART 3 EXECUTION

3.01 MATERIAL REMOVAL

A. Remove only existing roofing materials that can be replaced with new materials as the weather will permit.

B. Fold up metal counter flashings to permit access to top edge of base flashings.

C. Repair existing concrete deck surface to provide smooth working surface for new roof system.

3.02 FIELD QUALITY CONTROL

A. The drawings identify the exact limits to material removal.

3.03 PROTECTION

A. Provide temporary protective sheeting over uncovered deck surfaces.

B. Turn sheeting up and over parapets and curbing. Retain sheeting in position with weights.

C. Provide for surface drainage from sheeting to existing drainage facilities.

D. Do not permit traffic over unprotected or repaired deck surface.

END OF SECTION

SECTION 07180

TRAFFIC COATINGS

PART 1 GENERAL

1.01 SUMMARY

A. The work shall consist of providing the necessary labor, materials, equipment, and supervision for installation of a new traffic bearing topping on concrete surfaces as indicated in Contract Drawings.

B. This specification describes the application of a seamless waterproofing membrane resistant to specified traffic wear exposures. The specified products shall meet or exceed requirements of ASTM C957, High-Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with Integral Wearing Surface.

C. Description of System
   1. The traffic bearing topping will be a complete system of compatible materials from one manufacturer to create a seamless waterproof coating.
   2. The traffic bearing topping will be applied to the structural deck on the top level (roof level) and the ramps leading to the roof that are exposed as indicated in the Contract Drawings. In addition the ramps leading to the roof shall receive a traffic bearing topping of at least 30 feet into areas that are not exposed. The traffic bearing topping will also be installed within stairwells, stairs and intermediate landings. Turn-ups and terminations shall be installed as shown on Contract Drawings.

1.02 RELATED SECTIONS

A. Section 01550 – Access Roads, Parking Areas and Parking Controls

B. Section 01560 – Temporary Barriers and Closures

C. Section 03010 – Maintenance of Concrete

D. Section 07190 – Water Repellents

E. Section 07920 – Joint Sealants

F. Section 09910 – Traffic Stripping and Painting

1.03 QUALITY ASSURANCE

A. Manufacturing qualifications:

1. The manufacturer of the specified product shall be ISO9001/002 certified and have in existence a recognized ongoing quality assurance program independently audited on a regular basis.
2. The manufacturer shall have in existence for a minimum of ten (10) years a program of training, certifying and technically supporting a nationally organized Licensed Applicator Program.
3. Manufacturer shall provide evidence showing that specified materials have been manufactured by the same source and successfully installed on a yearly basis for a minimum of ten (10) years.

B. Contractor qualifications:
1. Contractor shall be qualified in the field of concrete repair and protection with a successful track record of 5 years or more. Contractor shall maintain qualified personnel who have received product training by a manufacturer's representative.
2. Applicator will be a Licensed Applicator of the manufacturer of the specified product who has completed a formal program of instruction in the use of the specified vehicular traffic topping system. Applicator shall have been a Licensed Applicator of the specified product for a minimum of three (3) years. Applicator will provide a certification attesting to their Licensed Applicator status at the time of bid.

C. Install materials in accordance with all safety and weather conditions required by manufacturer or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction. Consult Material Safety Data Sheets for complete handling recommendations.

1.04 REQUIREMENTS OF REGULATORY AGENCIES

A. The traffic bearing topping system shall be rated Class A by Underwriters Laboratories (ASTM E108/UL 790).

B. Materials used in the traffic bearing topping system shall meet existing solvent emission regulations (i.e. California Rule 66).

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's product literature, standard color samples and installation instructions and details, Product Data Sheet, and appropriate Material Safety Data Sheets (MSDS).

B. Submit three 2' x 2' samples of specified traffic bearing topping system. Samples shall be constructed as examples of finished color and texture of traffic bearing topping system only.

C. License Certificate: Submit a currently dated Applicators Certificate issued by the manufacturer. The certificate shall verify the applicator's qualifications to properly install the traffic bearing topping system and shall commit the manufacturer as a co-

signer under the joint responsibility provisions of the guarantee required by these specifications.

D. Guarantee: Upon completion of installation of the traffic bearing topping system, submit a joint manufacturer/applicator Guarantee certificate.
   1. Guarantee requirements: The materials and workmanship involved in this application shall be guaranteed on a single document signed by the manufacturer and Licensed Applicator for a period of five (5) years. In accordance with the provisions of the guarantee, ruptures caused by cracking of the substrate up to 1/16” in width are covered; otherwise no liability is assumed for defects in the substrate.

1.06 DELIVERY, STORAGE AND HANDLING

A. All materials must be delivered in original, unopened containers with the manufacturer’s name, labels, product identification, and batch number. Containers shall bear UL labels.

B. Damaged material must be removed from the site immediately.

C. Store all materials off the ground and protect from rain, freezing or excessive heat until ready for use. Do not store for long periods of time in direct sunlight.

D. Handle products to avoid damage to container.

E. Product shall be stored in conditions as recommended by the manufacturer.

1.07 JOB CONDITIONS

A. Environmental Conditions:
   1. Do not apply material if it is raining or snowing or if such conditions appear to be imminent. Minimum application temperature is 40 ºF (5 ºC) and rising.
   2. Do not apply materials unless surface to receive topping is clean and dry or if precipitation is imminent.
   3. Avoid dew point conditions during application, relative humidity must be no more than 95%and substrate temperature must be at least 5 ºF (3 ºC) above measured dew point temperature.
   4. Maximum moisture content of substrate: 4% by weight.

B. Protection:
   1. Warn personnel against breathing vapors and contact of materials with skin or eyes.
   2. In confined areas workmen shall wear approved chemical-cartridge type masks.
   3. Wear protective clothing.
   4. Keep products away from heat, sparks and flames. Do not allow use of spark producing equipment during application and until vapors are gone. Post "No Smoking" signs.

5. After completion of application do not allow traffic on coated surfaces for a period of at least 48 hours at 75 degrees F and 50% relative humidity or until completely cured.
6. Protect plants, vegetation and animals which might be affected by coating. Use drop cloths or masking as required.
7. Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified coating.

C. Construction:
1. Contractor shall perform all work while maintaining vehicular parking to site and within site that are not under construction in accordance with Section 01550 and Contract Drawings.
2. Contractor shall provide adequate signalization in accordance with Section 01560 and Contract Drawings.

1.08 PRECONSTRUCTION CONFERENCE

A. Prior to starting work under this section, the Contractor, any subcontractors, manufacturer's representative, Quality Control Engineer and AR shall meet to review substrate preparation, application procedures, testing procedures and special project requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sikalastic 710/715 Traffic System, as manufactured by Sika Corporation, 201 Polito Ave., Lyndhurst, NJ 07071, is considered to conform to the requirements of this specification or approved equal.

B. Any materials required for repair prior to installation shall be manufactured by the same supplier of the proposed traffic bearing topping system.

C. Specifications and drawings are based on manufacturer’s proprietary literature from Sika Corporation. Products from other manufacturers shall comply with minimum levels of materials and detailing indicated in Specifications Section 07180 and Contract Drawings. AR will be the sole judge of equivalency.

2.02 MATERIALS

A. Traffic Bearing Topping Material:
1. Primer: Two-part epoxy primer designed for concrete and metal flashings.
2. Liquid flashing: Manufacturer’s recommended elastomeric liquid flashing.
3. Aggregate: shall be clean, rounded, oven sized quartz with a minimum uniformly gradation of 16-30 mesh for vehicular traffic, and a minimum hardness of 6.5+ on Moh’s scale or approved by manufacturer. Aggregate shall be supplied in pre-packaged bags and free of metallic or other impurities.

4. Elastomeric Coating Material: Coating shall comply with ASTM C957 and be a single component, moisture cured, low odor polyurethane coating system

   (Heavy Duty) with integral wearing surface. Color selected from manufacturer's standard color by the Authority.
5. Sealant: Sealant shall be a polyurethane material as specified in Section 07920 and as approved by the Vehicular Traffic Bearing Topping Material manufacturer.

B. Approved product: Sikalastic 710/715 Traffic System is a complete system of compatible materials comprised of the following:
   1. Sikafloor FTP water-based epoxy primer or other primer recommended by manufacturer.
   2. Sikalastic 710 Base one-component aromatic polyurethane base coat
   3. Sikalastic 715 Top one-component aromatic polyurethane top coat
   4. Sikalastic 700 ACL accelerator (optional)
   5. Sikalatic 735 AL, 736 AL lo-VOC and 748 PA optional aliphatic top coats

C. Total dry film thickness exclusive of aggregate shall be 33 mils for pedestrian traffic, 43 mils for heavy pedestrian and light vehicular traffic, and 55 mils for heavy vehicular traffic. See data sheet System Guide for coverage rates and application methods.

2.03 PERFORMANCE CRITERIA

A. Properties of standard Sikalastic base and top coats:

	710 Base	715 Top
Viscosity	6500 +/- 3000 cps	1500 +/- 500 cps
Total Volume Solids (ASTM D2697)	71%	72%
VOC Content (ASTM D2369-81)	240 g/l	243 g/l
Tensile Strength (ASTM D412)	800 +/- 100 psi	3200 +/- 300 psi
Elongation at Break (ASTM D412)	500 +/- 50%	500 +/- 50%
Tear Resistance (Die C, ASTM D624)	250 +/- 25 pli	350 +/- 50 pli
Hardness (ASTM D2240)	55 +/- 5 Shore A	85 +/- 5 Shore A

B. Properties of optional Sikalastic aliphatic top coats:

	735 AL	736 AL lo-VOC	748 PA
Viscosity	2500 +/- 700 cps	3500 +/- 700 cps	200 +/- 50 cps
Total Volume Solids (ASTM D2697)	74%	83%	78%
VOC Content (ASTM D2369-81)	225 g/l	99 g/l	100 g/l
Tensile Strength (ASTM D412)	4200 +/- 300 psi	4000 +/- 300 psi	2500 +/- 200 psi
Elongation at Break (ASTM D412)	230 +/- 50%	250 +/- 50%	100 +/- 25%
Tear Resistance (Die C, ASTM D624)	400 +/- 50 pli	400 +/- 50 pli	300 +/- 50 pli
Hardness (ASTM D2240)	90 +/- 5 Shore A	90 +/- 5 Shore A	50 +/- 5 Shore A

C. Note: Tests were performed with material and curing conditions at 75 ºF and 50% relative humidity.

PART 3 EXECUTION

3.01 DEMOLITION AND INSPECTION

A. Concrete: Verify that the work done under these sections meets the following requirements:
   1. Perform all required demolition and removal of existing construction required to permit installation of the coating system.
   2. Verify that the concrete deck surface is free of ridges and sharp projections. Grind concrete surfaces as required to remove ridges and sharp projections.
   3. Verify that the concrete has cured for a minimum of 28 days. The use of concrete curing agents, if any, shall require written approval by the manufacturer. Curing agents used shall be removed prior to installation of the coating, if required by the manufacturer.

3.02 SURFACE PREPARATION

A. The substrate must be clean, dry, sound and free of surface contaminants. Remove all traces of dust, laitance, grease, oils, curing compounds, form release agents and foreign particles by mechanical means, i.e. – milling, scarifying, shot blasting, etc., as approved by the AR. Blow surface free of dust using compressed air line equipped with an oil trap Surface Preparation. Surface must be clean, dry and sound with an open texture. Remove dust, laitance, grease, curing. All projections, rough spots, etc. should be dressed off to achieve a level surface prior to the application. Installer shall use a moisture meter to verify moisture levels in substrate at time of preparation and application of traffic bearing topping.

B. Concrete should be cleaned and prepared to achieve a laitance contaminant free, open textured surface by blast cleaning or equivalent mechanical means (CSP 3-4 per ICRI guidelines).

C. Plywood should be clean and smooth, APA and exterior grade, not less than ½" thick, and spaced and supported according to APA guidelines. Seams should be sealed with Sikaflex 2c or 1a and detailed and may need embedded fabric reinforcement.

D. Metal should be thoroughly cleaned by grinding or blast cleaning

E. Cracks and cold joints: Visible hairline cracks in concrete and cold joints shall be cleaned, primed and treated with polyurethane deck coating material as recommended by bearing traffic topping manufacturer. Cracks 1/16 inch wide and larger shall be routed and sealed with polyurethane sealant in accordance with the procedures of Section 03010. The polyurethane sealant material shall be as specified in this Section. Sealant shall be applied to inside crack only, not applied to deck surface. Detail sealed crack with polyurethane deck coating material as recommended by traffic bearing topping manufacturer.

F. Control joints: Rout and seal control joints with polyurethane sealant in accordance with the procedures of Section 03010. The polyurethane sealant material shall be as specified in this Section.

G. Elevation Tolerances: Grind and dress edges of concrete double tee flanges and beam edges to within 1/16" in elevation at the following locations:
   1. Concrete double tee flange-to-flange interfaces.
   2. Concrete double tee flange to concrete inverted tee interfaces.
   3. Concrete double tee flange to concrete "L" beam interfaces.

H. Wall Terminations and Expansion Joints: Install saw cuts and sealant cants as detailed in the Contract Drawings. The coating system primer, base coat and top coat shall be installed as detailed in the Contract Drawings.

I. Surface condition: Surface shall be clean and dry prior to coating.

3.03 APPLICATION AT HORIZONTAL DECK SURFACES

A. Coordinate application of urethane membrane coating with application of water repellent coating (Section 07190).

B. Coordinate application of urethane membrane coating with traffic striping and pavement markings as per Section 09910.

C. Apply system in accordance with the manufacturer's specifications, if different from the following requirements. The system shall be applied to obtain the following minimum system thickness.

D. Traffic Bearing Urethane Topping: An average of 52 dry mils nominal thickness, exclusive of aggregate.

E. At drains, clean and prime the throat of the drain. Extend the coating system into the drain throat.

F. Coating system shall be turned up at parapet walls and ramp walls as detailed in Contract Drawings.

3.04 PRIMING

A. Concrete and plywood – Apply Sikafloor FTP primer at 300 sf./gal. with a flat squeegee or roller and work well into the substrate to insure adequate penetration and sealing and puddles are avoided. Refer to data sheet for detailed information, or consult Sika for other primer options.

B. Premix both components. Sikafloor FTP, Part "H" is dark olive green in color and may appear black in the container. Sikafloor FTP, Part "R" is light amber in color. Add the 1 gallon of Sikafloor FTP. Part "R" to the 1.25 gallons of Part "H" in the short

filled Part “H” pail Mix thoroughly with a mechanical mixer (jiffy) for 3 minutes. This mixture will appear as a light olive green color. Slowly add 1.25 gallons of potable water to the mixture under agitation. Mix for an additional 2 minutes until the mixture is fully dispersed. Fully dispersed material will appear as light green in color. Allow primer to cure a minimum of 3-4 hours at 70 ºF and 50% RH or until tack free before applying base coat.

C. Metal – Consult Sika regarding primer.

3.05 DETAILING

A. Non-structural cracks up to 1/16 inch – Apply a detail coat of Sikalastic 710 Base at 32 mils wet, 4” wide, centered over the crack. Allow to become tack free before overcoating.

B. Cracks and joints over 1/16 inch up to 1 inch – Route and seal with Sikaflex 2c or 1a sealant and allow to cure. Apply a detail coat of Sikalastic 710 Base at 32 mils wet, 4” wide, centered over crack. Allow to become tack free before overcoating.

C. Joints over 1 inch – Should be treated as expansion joints and brought up through the Sikalastic Traffic System and sealed with Sikaflex 2c or 1a sealant.

3.06 BASE COAT

A. Thoroughly mix Sikalastic 710 Base using a mechanical mixer (Jiffy) at slow speeds until a homogenous mixture and color is obtained. Use care not to allow the entrapment of air into the mixture. Apply at the recommended coverage rate (See System Guide) using a notched squeegee or trowel and backroll using a phenolic resin core roller. Extend base coat over entire area including previously detailed cracks and control joints. Allow coating to cure a minimum of 16 hours at 70 ºF and 50% RH or until tack free before top coating.

3.07 TOP COATS

A. Thoroughly mix Sikalastic 715 Top or optional using a mechanical mixer (Jiffy) at slow speeds until a homogenous mixture and color is obtained. Use care not to allow the entrapment of air into the mixture. Apply at the recommended coverage rate (See System Guide) using a flat or notched squeegee and backroll using a phenolic resin core roller. Apply aggregate evenly distributed at the appropriate rate immediately into wet coating and backroll if required (see System Guide). Allow coating to cure a minimum of 16 hours at 70 ºF and 50% RH or until tack free between coats, and a minimum of 72 hours before opening to vehicular traffic.

B. Refer to mixing and application instructions in separate data sheet for optional Sikalastic 735 AL, 736 AL Lo-VOC and 748 PA aliphatic top coat substitutions.

3.08 ACCELERATOR

A. Sikalastic 700 ACL may be added to Sikalastic 710 Base, 715 Top or optional single component aliphatic top coats in order to accelerate cure time, particularly in cold weather conditions. Maximum amount that may be added is 1:20 ratio (1 quart to 5 gallons). Apply only to material that will be applied within 2-3 hours.

3.09 MOCK-UP

A. A 4 ft. by 4 ft. job site mock-up at each site is required prior to the installation of the traffic bearing topping to confirm acceptability of workmanship, material coverage rates and aesthetics. Mock-up will be tested for proper adhesion. Do not start membrane installation until mock-up has been accepted.

3.10 QUALITY CONTROL

A. The Quality Control Engineer shall verify surface preparation, crack preparation, detail coat application, wet mil application thickness and aggregate application rates.

3.11 CLEANING

A. Uncured materials can be removed from tools or other surfaces with an approved solvent. Cured materials can only be removed by mechanical means.

B. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

C. Remove debris resulting from completion of coating operation from the project site.

END OF SECTION

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SECTION 07190

WATER REPELLENTS

PART 1 GENERAL

1.01 SUMMARY

A. The work to be performed includes furnishing all labor, materials, and equipment necessary to apply the specified surface treatment to horizontal concrete surfaces of elevated concrete decks, with the exception of those on the top level.

B. The coating will be applied to the ramps leading to the elevated concrete decks with the exception of the top level.

C. Section Includes:
   1. Alkylalkoxysilane penetrating water repellent sealer for exterior above grade horizontal or vertical surfaces as scheduled.

1.02 RELATED SECTIONS:

A. Section 01400 – Quality Control and Assurance Requirements

B. Section 01550 – Access Roads, Parking Areas and Parking Controls

C. Section 01560 – Temporary Barriers and Closures

D. Section 07180 – Traffic Coatings

E. Section 09910 – Traffic Stripping and Painting

1.03 SUBMITTALS

A. Contractor shall submit the following items to the AR prior to construction:
   1. A copy of the applicator’s certification issued by the manufacturer.
   2. Product Data: Submit the sealer manufacturer's technical data sheets and LEED product information for each product. Include generic description, surface preparation and application instructions.
   3. MSDS Sheets indicating safety precautions.
   4. Manufacturer’s Quality Assurance: Submit manufacturer’s certification that coatings comply with specified requirements and are suitable for intended application.
   5. Warranty: Submit manufacturer’s standard warranty form with authorized signatures and endorsements.
   6. Submit list of project references as documented in this Specification under Quality Assurance Article. Include contact name and phone number of person charged with oversight of each project.
   7. Quality Control Submittals:
      a. Provide protection plan of surrounding areas and non-work surfaces.

1.04 QUALITY ASSURANCE

A. Comply with Section 01400.

B. Qualifications:
   1. Manufacturer Qualifications: Company with minimum 15 years of experience in manufacturing of specified products.
   2. Manufacturer Qualifications: Company shall be ISO 9001:2000 Certified.
   3. Manufacturer shall be able to demonstrate successful performance on comparable projects.
   4. Applicator Qualifications: Company with minimum of 5 years experience in application of specified products on projects of similar size and scope, and is acceptable to product manufacturer.
      a. Successful completion of a minimum of 5 projects of similar size and complexity to specified Work.
      b. Applicator will be a licensed Applicator of the manufacturer of the specified product who has completed a formal program of instruction in the use of the specified water repellant coating system.
      c. Applicator will provide certification attesting to their Licensed Applicator status at time of bid.

C. Pre-application Meeting: Convene a pre-application meeting two (2) weeks before start of application of coating systems. Require attendance of parties directly affecting work of this section, including Contractor, Quality Control Engineer, applicator, and manufacturer's representative. Review the following:
   1. Environmental requirements.
   2. Protection of surfaces not scheduled to be coated.
   3. Surface preparation.
   4. Application.
   5. Repair.
   6. Field quality control.
   7. Cleaning.
   8. Protection of coating systems.
   9. Coordination with other work.

D. Field Sample:
   1. Install at Project site or pre-selected area of building an area for field sample (mock-up), as directed by Quality Control Engineer or AR.
      a. Provide mockup of at least Five (5) by Five (5) feet minimum to include surface preparation, sealant joint, and juncture details and allow for evaluation of repellent performance and finish.
      b. Mock-up Substrate: Horizontal concrete surfaces.
      c. Maintain mock-up during construction for workmanship standard.
      d. Mock-up may be incorporated into final construction upon Quality Control Engineer/AR approval.
      e. Field sample will be standard for judging workmanship on remainder of Project.

f. Obtain Quality Control Engineer or AR written approval of field sample before start of material application, including approval of aesthetics, color, texture, and appearance.
g. Conduct absorption test on cured field sample. Adjust application until required repellent performance is achieved.
h. Apply material in accordance with manufacturer's written application instructions.

2. Manufacturer's representative or designated representative will review technical aspects; surface preparation, application, and workmanship.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle and protect all products in accordance with the manufacturer's recommendations.

B. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

C. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Store in unopened containers in clean, dry area between 35 degrees F (2 degrees C) and 110 degrees F (43 degrees C).

1.06 PROJECT CONDITIONS

A. Environmental Requirements:
1. In accordance with manufacturer's recommendations, substrate and ambient temperature shall be 40 degrees F (4 degrees C) and rising at installation time and remain above 40 degrees F for at least 12 hours after installation.
2. Weather Conditions: In accordance with manufacturer's instructions, do not apply water repellents in snow, rain, or mist, or when such conditions are expected. Allow surfaces to attain temperature ranges and conditions recommended by manufacturer before proceeding with installation. Do not apply in rain or when rain is expected within 4 hours. Do not apply above 96 degrees F (35 degrees C) or below 40 degrees F (4 degrees C) or when temperatures are expected to fall below 20 degrees F (minus 7 degrees C) within 12 hours.
3. Compliance: Follow manufacturer's instructions with regard to safety, health, and other related environmental precautions. Comply with all applicable Federal, State, and Local Environmental Regulations.

B. Protection:
1. Warn personnel against breathing vapors and contact of materials with skin or eyes.
2. In confined areas workmen shall wear approved chemical-cartridge type masks.
3. Wear protective clothing.

4. Keep products away from heat, sparks and flames. Do not allow use of spark producing equipment during application and until vapors are gone. Post "No Smoking" signs.

C. Construction:
   1. Contractor shall perform all work while maintaining vehicular parking to site and within site that are not under construction in accordance with Section 01550 and Contract Drawings.
   2. Contractor shall provide adequate signalization in accordance with Section 01560 and Contract Drawings.

1.07 REFERENCE STANDARDS

A. ICRI Guideline No. 03732 – “Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays”, January 1997.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products from the following manufacturers:
   1. BASF Building Systems:
      889 Valley Park Drive
      Shakopee, MN 55379
      Customer Service: 800-433-9517
      Technical Service: 800-243-6739
      Direct Phone: 952-496-6000
      Internet: www.BASFbuildingsystems.com

   2. Vexcon Chemicals Inc.
      7240 State Road
      Philadelphia, PA 19135
      Customer Service: 888-839-2661
      Internet: www.vexcon.com

   3. Or approved equal.

B. Specifications and Drawings are based on manufacturer's proprietary literature from BASF Building Systems. Other manufacturers shall comply with minimum levels of material and detailing indicated in Specifications or on Drawings. AR will be sole judge of appropriateness of substitutions.

2.02 MATERIALS

A. Clear, breathable, 100 percent alkylalkoxysilane penetrating sealer. Penetrates deeply and chemically reacts with concrete to form long-lasting water-repellent surface.
   1. Acceptable Product: Hydrozo 100 by BASF Building Systems.
   2. Or approved equal.

2.03 PERFORMANCE REQUIREMENTS

A. Sealer shall have the following minimum performance:
   1. Active Alkylalkoxysilane Content by Weight: 100 percent.
   2. Penetration, average depth, depending upon substrate: 0.20 inch (5 mm).
   3. Surface Appearance After Application: Unchanged.
   4. Flash Point, SETA, IPA: 53 degrees F (12 degrees C).
   5. Waterproofing After Abrasion, Alberta Transportation and Utilities Type 1B, 225 sf. per gal. (5.6 m2/L): 88.4 percent.
   6. Resistance to Chloride:
      a. Criteria of 1.5 at 1/2 inch: Less than 0.2 lb. per cy.
      b. Criteria of 0.75 at 1 inch: 0.00 lb. per cy.
   7. Water Weight Gain, NCHRP 244 Series II Cube Test, 200 sf. per gal (5 m2/L): 86 percent, exceeds criteria.
   8. Absorbed Chloride, NCHRP 244 Series II Cube Test, 200 sf. per gal (5 m2/L): 92 percent, exceeds criteria.
   9. Absorbed Chloride, NCHRP 244 Series IV Southern Climate, 200 sf. per gal (5 m2/L): 99 percent, exceeds criteria.
   10. Moisture-Vapor Transmission Rate, OHD-L-35: 102 percent.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's most recently published technical bulletins including installation instructions, substrate testing, and surface preparation and cleaning, and post installation testing.

3.02 EXAMINATION

A. Verify substrate conditions are acceptable for water repellent system installation accordance with manufacturer's instructions.
   1. General: Determine acceptable removal techniques for contaminants harmful to water repellent performance, such as dust, dirt, grease, oils, curing compounds, form release agents, laitance, efflorescence, existing films and other water repellent coatings.
   2. Concrete: Verify concrete substrates have cured to full load bearing capacity (14-28 days).

3.03 SURFACE PREPARATION

A. A. Surfaces to be treated will be cleaned of dust, dirt, oil, grease, coatings, debris and other contaminants in accordance with procedures outlined in Section 3.03 D

B. Perimeter of areas to be coated shall be masked, to avoid coating adjacent surfaces. Protect adjacent work areas and finish surfaces from damage during water repellent system installation.

C. All caulking, patching, and joint sealing shall be completed prior to application of the penetrating concrete sealer.

D. Prior to installation, clean substrates that could impair penetration or reaction of water repellent system. Coordinate cleaning and application to avoid contamination of newly treated surfaces. Prepare surfaces as follows:
   1. The slab surface shall be broom swept to remove heavy dust and/or debris. Soiled or grease stained surfaces to be sealed shall be cleaned with SureKlean degreaser and etch, as follows:
      a. Wet the area to be cleaned.
      b. Dilute degreaser and etch per the manufacturer’s specifications and apply to the stained areas by brush or spray.
      c. Allow solution to stand, then apply a second coat and scrub the area with a stiff bristle brush.
      d. Rinse the area with fresh water using low pressure water cleaning equipment.
      e. Repeat the applications as required to remove heavily oil and grease stains.
   2. Concrete surfaces to be sealed shall receive a light abrasive blasting to remove surface contaminants. Surface profile shall be CSP3 or CSP4 as defined by ICRI Guideline No. 03732.

E. Test and clean substrates in accordance with manufacturer's printed recommendations and the following National standards:
   1. ASTM 0 4258, Surface Cleaning Concrete for Coating.
   2. ASTM 0 4262, Test Method for pH of Chemically Cleaned Concrete.
   3. ASTM 0 4259, Abrading Concrete.

F. Substrates shall be clean, dry, sound, and free of contaminants detrimental to water repellent system performance.
   1. Remove contaminants by approved methods demonstrated at mock-up.
   2. Allow cleaned, damp, or water soaked surfaces to become totally dry before installation.
   3. Efflorescence, mold, and mildew shall be treated, neutralized and removed prior to water repellent installation.
   4. Do not apply sealer if standing water is visible on surface to be treated.

G. Protection: Protect plant life and surfaces to remain uncoated during application. Use drop cloths or masking as required.

H. Prepare surfaces in accordance with manufacturer's instructions.

3.04 APPLICATION

A. Coordinate application of water repellent with traffic striping and pavement markings as per Section 09910.

B. The coating shall be applied as packaged. Do not dilute or alter the material.

C. Apply transparent water repellent to properly prepared surfaces indicated. Apply water repellent within time restrictions after mixing and surface preparation as recommended by manufacturer.

D. Apply water repellent by low pressure spray techniques recommended by manufacturer. Spray equipment shall be equipped with solvent-resistant gaskets and hoses. Maintain the appropriate coverage rates as specified by the product manufacturer.

E. Caulking, patching, and expansion joint sealants shall be installed prior to application. Allow 6-12 hours for caulking and sealant materials to cure (or until they are set).

F. Surface, air, and materials temperatures should be maintained between 40 degrees F and 100 degrees F during the application process, or as specified by the manufacturer. Do not perform coating if temperature is expected to fall below 40 degrees F and within 12 hours after completion of application.

G. Surfaces to be treated must be dry. Do not apply if frost, ice, or standing water are visible on the surface to be treated.

H. Apply sealer in accordance with manufacturer's instructions.

I. Apply sealer, water-based products from the bottom up (on vertical surfaces) with total saturation providing an 8-12 inch controlled run down. For horizontal application, apply flood coat to saturation working to a wet edge. The product may be poured down followed by brooming with a medium, stiff bristle push broom or equivalent.

J. Apply water repellent material as demonstrated and approved at mock-up and not less than manufacturer's minimum recommended coverage rate. Coverage of approximately 100-200 square feet per gallon can be attained depending on substrate porosity, texture and profile.

K. Excess coating on the treated surfaces must be broomed out thoroughly until they completely penetrate.

L. Stir material thoroughly before and during application.

M. Apply even distribution of sealer.

N. Match approved samples for warrantable performance, appearance, and coverage. Remove, reapply or re-coat work not in compliance with Contract Documents or Manufacturer's Warranty Requirements.

O. Treated surfaces must be protected from rain and other water for a period of not less than eight (8) hours after application.

P. Treated surfaces must be protected from excessive foot and/or vehicular traffic for a period of not less than eight (8) hours after application, or until dry. Check for slip hazards before pedestrian and/or vehicular traffic is permitted on the surface.

3.05 FIELD QUALITY CONTROL

A. The Quality Control Engineer shall inspect surface preparation for compliance with this Section. Material application rates and the total quantity of material used on the work area shall be recorded. Average application rates per square foot of surface area shall be calculated and compared to that required. Additional coats shall be applied where the application rates are 5 percent or more less than the specified application rates.

B. Post Installation Testing: Owner reserves the right to complete recommended testing required by the manufacturer at completion of work to assure warranty requirements, and contract compliance are met.

3.06 CLEANING AND PROTECTION

A. Remove temporary coverings and protection of adjacent work areas. Remove over-spray from windows or areas not intended to be coated with hot soap-water solution.

B. Remove construction debris resulting from work.

C. Protect sealer from damage during construction.

END OF SECTION

SECTION 07210
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at cavity wall construction and wall construction.

B. Batt insulation in exterior wall construction.

1.02 RELATED SECTIONS

A. Section 06100 - Rough Carpentry.

1.03 REFERENCE STANDARDS

A. ASTM C240 - Standard Test Methods of Testing Cellular Glass Insulation Block; 2008e1.

B. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2007.

C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2010a.

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2010.

E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2006.

F. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2010.

G. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2006.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010b.

PART 2 PRODUCTS

2.01 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene Board Insulation: ASTM C578, Type X; Extruded polystyrene board with either natural skin or cut cell surfaces; with the following characteristics:

1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.

2.02 FIBER BOARD INSULATION MATERIALS

A. Mineral Fiber Board Insulation: Rigid mineral fiber, ASTM C612; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
   1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.

2.03 ACCESSORIES

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT WALLS

A. Install boards to fit snugly between wall ties.

B. Install boards horizontally on walls.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

C. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

END OF SECTION

SECTION 07521
STYRENE-BUTADIENE-STYRENE (SBS)
MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. SBS-modified bituminous membrane roofing.

B. Base sheet.

1.02 RELATED SECTIONS

A. Section 06100 – Rough Carpentry

B. Section 07620 – Sheet Metal Flashing and Trim

C. Section 07950 – Expansion Control

1.03 REFERENCES

A. Roofing Terminology: Refer to the following publications for definitions of roofing work related terms in this Section:
   1. ASTM D 1079 “Terminology Relating to Roofing and Waterproofing.”
   2. Glossary of NRCA's "The NRCA Roofing and Waterproofing Manual.”
   3. Roof Consultants Institute “Glossary of Roofing Terms” for definition of terms related to roofing work in this Section.

B. Sheet Metal Terminology and Techniques: SMACNA Architectural Sheet Metal Manual.

C. Hot Roofing Asphalt: Roofing asphalt heated to temperature recommended by roofing manufacturer to flux modified roofing membrane, measured at the mop cart or mechanical spreader immediately before application.

1.04 DESIGN CRITERIA

A. General: Installed roofing membrane system shall remain watertight; and resist specified wind uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Roofing materials shall be compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

C. Wind Uplift Performance: Roofing system shall be identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressure calculated in accordance with ASCE-7.

D. FMG Listing: Roofing membrane, base flashings, and component materials shall comply with requirements in FMG 4450 and FMG 4470 as part of a roofing system and that are listed in FMG's “RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

E. EPA Energy Star:
   1. Roofing membrane shall achieve an initial reflectance of greater than 0.65 and a three year aged reflectance of greater than 0.50.

1.05 SUBMITTALS

A. Product Data: Manufacturer’s data sheets for each product to be provided.

B. Detail Drawings: Provide roofing system plans, elevations, sections, details, and details attachment to other Work, including:
   1. Base flashings, cants, and membrane terminations.
   2. Tapered insulation, including slopes.
   3. Crickets, saddles, and tapered edge strips, including slopes.
   4. Insulation fastening patterns.

C. Verification Samples: Provide 12” x 12” samples for each product specified.

D. Maintenance Data

E. Guarantees: Special guarantees specified in this Section.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive the specified manufacturer's guarantee.

B. Manufacturer Qualifications: A qualified manufacturer that has UL listing and/or FMG approval for roofing system identical to that used for this Project.

C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

D. Test Reports:
   1. Roof drain and leader test or submit plumber’s verification.
   2. Core cut (if requested).
   3. Roof deck fastener pullout test.

E. Moisture Survey:
   1. Submit prior to installation, results of a non-destructive moisture test of roof system completed by approved third party. Utilize one of the approved methods:
      a. Infrared Thermography
      b. Nuclear Backscatter

F. Source Limitations: Obtain all components from the single source roofing system manufacturer guaranteeing the roofing system. All products used in the system shall be labeled by the single source roofing manufacturer issuing the guarantee.

G. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
   1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.
   2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.08 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when current and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and guarantee requirements.

1.09 GUARANTEE

A. Contractor's Guarantee:

1. Two year written guarantee covering defects in materials and/or workmanship. Performance Bond shall be for the entire two-year period. Also includes repair to all ancillary areas damaged due to leaks.

B. Manufacturer's Warranty
   1. In addition to the Contractor's guarantee, furnish the membrane manufacturer's printed No-Dollar-Limit 20-year warranty for the Work of this Section. The warranty shall include but not be limited to, repair or replacement of components of the roofing system that fail in materials or workmanship. Failure includes roof leaks.
   2. The warranty shall cover all components of the Work of this Section, including but not limited to asphalt primer, asphalt, sheets, membranes, insulation, base flashing, cements, warrantable penetration seals, penetration flashing and low flashing, coatings, expansion joints, fasteners, and cants. The roof system shall be warranted to remain watertight for 20 years. In the event that defects or leaks occur the manufacturer shall make repairs to correct them.

PART 2 PRODUCTS

2.01 SBS-MODIFIED ASPHALT-SHEET MATERIALS

A. Roofing Membrane Sheet: SBS-modified asphalt sheet; smooth surfaced; suitable for application method specified.
   1. Basis of Design: Johns Manville DynaLastic 180 S or approved equal.

B. Roofing Membrane Cap Sheet: SBS-modified asphalt sheet; granular surfaced; suitable for application method specified.
   1. Basis of Design: DynaLastic 180 FR or approved equal.

2.02 BASE FLASHING SHEET MATERIALS - SBS

A. Backer Sheet: ASTM D 4601, Type II, asphalt-impregnated and coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.
   1. Basis of Design: PermaPly 28 or architect approved equal.

B. Backer Sheet: SBS-modified asphalt sheet; smooth surfaced; suitable for application method specified.
   1. Basis of Design: DynaLastic 180 S or approved equal.

C. Flashing Sheet: SBS-modified asphalt sheet; granular surfaced; suitable for application method specified.
   1. Basis of Design: DynaLastic 250 FR or approved equal.

D. Liquid Applied Flashing: A liquid and fabric reinforced flashing system created with a stitchbonded polyester scrim and a two-component, moisture cured, elastomeric, liquid applied flashing material, consisting of an asphalt extended urethane base material and an activator.

1. Basis of Design: PermaFlash System or approved equal.

2.03 AUXILIARY ROOFING MEMBRANE - BITUMINOUS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with built-up roofing.

B. Roofing Asphalt: ASTM D 312, Type IV.

C. Asphalt Primer: ASTM D 41.

D. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application.
   1. Basis of Design: Bestile Industrial Roof Cement or approved equal.

E. Cold-Applied Flashing Adhesive: Roofing system manufacturer's asphalt-based, two-component, asbestos-free, trowel-grade, cold-applied adhesive specially formulated for compatibility and use with flashing applications.
   1. Basis of Design: MBR Flashing Cement or approved equal.

F. Mastic Sealant: As required by Johns Manville.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roofing membrane components to substrate, tested by manufacturer for required pullout strength, and provided by the roofing system manufacturer.

H. Roofing Granules: Ceramic-coated roofing granules matching specified cap sheet, provided by roofing system manufacturer.

I. Coating: Acrylic elastomeric coating with unique bleed-blocking properties particularly well suited for coating over asphalt surfaces.
   1. Basis of Design: Johns Manville CR Seam Coating or approved equal.

J. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

2.04 AUXILIARY ROOFING SYSTEM COMPONENTS

A. Expansion Joints: Provide factory fabricated weatherproof, exterior covers for expansion joint openings consisting of flexible rubber membrane, supported by a closed cell foam to form flexible bellows, with two metal flanges, adhesively and mechanically combined to the bellows by a bifurcation process. Provide product manufactured and marketed by single-source membrane supplier that is included in the No Dollar Limit guarantee.
   1. Basis of Design: Johns Manville “Expand-O-Gard” or approved equal.

B. Coping System: Manufacturer's factory fabricated coping consisting of a base piece and a snap-on cap. Provide product manufactured and marketed by single-source membrane supplier that is included in the No Dollar Limit guarantee.

C. Fascia System: Manufacturer's factory fabricated fascia consisting of a base piece and a snap-on cover. Provide product manufactured and marketed by single-source membrane supplier that is included in the No Dollar Limit guarantee.

D. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing and Trim."

2.05 REFLECTIVE AND WATERPROOF COATING

A. Elastomeric Coating: ASTM D 6083. A multipurpose, acrylic elastomeric coating for use over a variety of substrates with bleed-blocking properties for coating over asphalt surfaces.
   1. Basis of Design: Johns Manville "TopGard 5000" or approved equal.

2.06 WALKWAYS

A. Walkway Pads: Mineral-granule-surfaced, reinforced modified asphalt composition, slip-resisting pads, manufactured as a traffic pad for foot traffic provided by roofing system manufacturer, with a pad size of 32 inch x 32 inch.
   1. Basis of Design: Johns Manville "DynaTred Plus" or approved equal.

2.07 BASE-SHEET MATERIALS

A. Base Sheet: ASTM D 4601, Type II nonperforated, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.
   1. Basis of Design: GlasBase Plus or approved equal.

B. Base Sheet: ASTM D 4897, Type II, venting, nonperforated, heavyweight, asphalt-impregnated and -coated, glass-fiber base sheet with coarse granular surfacing or embossed venting channels on bottom surface.
   1. Basis of Design: Ventsulation Felt or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements affecting performance of roofing system:

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

3.02 PREPARATION

A. Clean and remove from substrate sharp projections, dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer's written instructions.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.

C. Prime surface of concrete deck with asphalt primer at a rate recommended by roofing manufacturer and allow primer to dry.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 RE-ROOF PREPARATION

A. Remove all roofing membrane, surfacing, coverboards, insulation, fasteners, asphalt, pitch, adhesives, etc.
   1. Remove an area no larger than can be re-roofed in one day.

B. Tear out all base flashings, counterflashings, pitch pans, pipe flashings, vents and like components necessary for application of new membrane.

C. Remove abandoned equipment curbs, skylights, smoke hatches, and penetrations.
   1. Install decking to match existing as directed by Owner's Representative.

D. Raise (disconnect by licensed craftsmen, if necessary) all HVAC units and other equipment supported by curbs to conform with the following:
   1. Modify curbs as required to provide a minimum 8" base flashing height measured from the surface of the new membrane to the top of the flashing membrane.
   2. Nail top of flashing and install new metal counterflashing prior to re-installation of unit.
   3. Perimeter nailers must be elevated to match elevation of new roof insulation.

E. Immediately remove all debris from roof surface. Demolished roof system may not be stored on the roof surface.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.04 RECOVER PREPARATION

A. Prepare existing roof according to roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer, and requirements in this Section.

B. Tear out all base flashings, counterflashings, pitch pans, pipe flashings, vents and like components necessary for application of new membrane.

C. Disable existing roof membrane by cutting a minimum 5 foot x 5 foot grid pattern.

D. “Skin” existing membrane at substrate.

E. Remove existing membrane at fasteners.

F. Remove and replace wet, deteriorated or damaged roof insulation and decking as identified in moisture survey.

G. Remove abandoned equipment curbs, skylights, smoke hatches, and penetrations. Install decking to match existing as directed by Owner's Representative.

H. Raise, (disconnect by licensed craftsmen, if necessary) all HVAC units and other equipment supported by curbs to conform with the following:
   1. Modify curbs as required to provide a minimum 8" base flashing height measured from the surface of the new membrane to the top of the flashing membrane.
   2. Nail top of flashing and install new metal counterflashing prior to re-installation of unit.
   3. Perimeter nailers must be elevated to match elevation of new roof insulation.

I. Immediately remove all debris from roof surface. Demolished roof system may not be stored on the roof surface.

J. Prime existing cap sheet to prepare for recover application.

K. Proceed with installation only after unsatisfactory conditions have been corrected.

3.05 BASE-SHEET INSTALLATION

A. Install one lapped base sheet course and mechanically fasten to substrate according to roofing system manufacturer's written instructions.
   1. Enhance fastening rate in perimeter and corner zones according to code or manufacturer, whichever is more stringent.

B. Comply with roofing system manufacturer's written instructions for installing roof insulation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.06 ROOFING MEMBRANE INSTALLATION, GENERAL

A. Install roofing membrane in accordance with roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer and requirements in this Section.

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

C. Where roof slope exceeds 1/2 inch per 12 inches (1:24, contact the membrane manufacturer for installation instructions regarding installation direction and backnailing

D. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.

E. Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is imminent.
   1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.
   2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
   3. Remove and discard temporary seals before beginning work on adjoining roofing.

F. Asphalt Heating: Heat roofing asphalt to temperature recommended by roofing manufacturer to flux modified membrane. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Discard roofing asphalt maintained at a temperature exceeding finished blowing temperature for more than 4 hours.

G. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

H. Proceed with installation only after unsatisfactory conditions have been corrected.

3.07 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

A. Install two modified bituminous roofing membrane sheet and cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:
   1. Adhere to substrate in a solid mopping of hot roofing asphalt applied at temperatures recommended by roofing system manufacturer.

2. Adhere to substrate in cold-applied adhesive according to roofing system manufacturer's instruction.
3. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.

B. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
1. Repair tears and voids in laps and lapped seams not completely sealed.
2. Apply roofing granules to cover exuded bead at laps while bead is hot.

C. Install roofing membrane sheets so side and end laps shed water.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.08 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
1. Prime substrates with asphalt primer if required by roofing system manufacturer.
2. Backer Sheet Application: Mechanically fasten backer sheet to walls or parapets. Adhere backer sheet over roofing membrane at cants in a solid mopping of hot roofing asphalt.
3. Backer Sheet Application: Install backer sheet and adhere to substrate in a solid mopping of hot roofing asphalt.
4. Backer Sheet Application: Install backer sheet and self adhere to substrate as required by roofing system manufacturer.
5. Flashing Sheet Application: Adhere flashing sheet to substrate in a solid mopping of hot roofing asphalt applied at EVT. Apply hot roofing asphalt to back of flashing sheet if recommended by roofing system manufacturer.
6. Flashing Sheet Application: Adhere flashing sheet to substrate in approved asphalt roofing cement; apply cement at rate required by roofing system manufacturer.

B. Extend base flashing up walls or parapets a minimum of 8 inches (200 mm) above roofing membrane and 4 inches (100 mm) onto field of roofing membrane.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
1. Seal top termination of base flashing with a strip of glass-fiber fabric set in MBR Flashing cement.

D. Roof Drains: Set 4 lb lead flashing sheet in a bed of manufacturer approved flashing cement on completed roofing membrane. Cover metal flashing with roofing membrane cap-sheet stripping and extend a minimum of 4 inches beyond edge of

metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.

E. Roof Drains: Flash drain using manufacturer approved system. Clamp roofing membrane, flashing, and stripping into roof-drain clamping ring.
   1. Install stripping according to roofing system manufacturer's written instructions.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.09 COATING INSTALLATION

A. Ensure that all surfaces are clean, dry and free of any dirt, grease, oil or other debris that may interfere with proper adhesion.

B. Apply coating to roofing membrane and base flashings as recommended by the manufacturer using approved spray apparatus**.** Apply in two coats allowing the first coat to completely dry before applying the second coat.

3.10 WALKWAY INSTALLATION

A. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size according to walkway pad manufacturer's written instructions.
   1. Sweep away loose aggregate surfacing and set walkway pads in additional flood coat of hot roofing asphalt.

B. Walkway Cap Sheet Strips: Install roofing membrane walkway cap sheet strips over roofing membrane in hot roofing asphalt.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

B. Final Roof Inspection: Arrange for roofing system manufacturer's Registered Roof Observer (RRO) to inspect roofing installation on completion and submit report to Architect.

C. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.12 PROTECTION AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period.

B. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07620

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SUMMARY

A. This section includes all sheet metal flashing related to the water proofing of the stair bulkhead roofs as shown on the contract drawings.

1.02 RELATED SECTIONS

A. Section 06100 – Rough Carpentry

B. Section 07920 – Joint Sealants

C. Section 07521 – Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing

1.03 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing.

B. Fabricate and install flashings at roof edges to comply with recommendations of FM Loss Prevention Data Sheet 1-49 for the following wind zone:
   1. Wind Zone 3: Wind pressures of 46 to 104 psf.

1.04 SUBMITTALS

A. Submit the following for approval in accordance with the General Requirements and with the additional requirements as specified for each:
   1. Product Data including manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.
   2. Shop Drawings:
      a. Show both shop-fabricated and site-fabricated work, indicating where each item is fabricated. Include complete details of joints, supports and fasteners, in accordance with SMACNA Architectural Sheet Metal Manual standard details where applicable.
      b. Show dimensions and locations of wood nailing strips, miscellaneous wood supports and details of installation.

c. Fabricated Masonry Flashing: Detail corner units, end-dam units, and other special applications.

3. Samples: Three of each type of the following materials used in the work:
   a. Stainless steel: 6 inches in length of each flashing/counter-flashing profile used.
4. Certifications.

1.05 QUALITY ASSURANCE

A. Codes, Regulations, Reference Standards and Specifications:
   1. Comply with codes and regulations of the jurisdictional authorities.
   2. SMACNA: Architectural Sheet Metal Manual.
   3. FS: QQ-L-201, UU-B-790.
   4. AAMA: 606.1.
   5. NRCA: Roofing and Waterproofing Manual.
   6. ASTM: A167, A755, B32, B101, B209, B221, B370.
   7. UL: 580 for Class 90 wind-uplift resistance.
   8. FM: Loss Prevention Data Sheet 1-49.
   9. Copper Development Association: Copper in Architecture Handbook.

B. Installer Qualifications: Engage an experienced Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver products to jobsite in original unopened containers clearly marked with manufacturer's name and brand designation, reference specification number, type and class as applicable.

B. Store products in approved dry area and protect from contact with soil and exposure to the elements. Keep products dry.

C. Handle products so as to prevent breakage of containers and damage to products.

PART 2 PRODUCTS

2.01 MATERIALS

A. Stainless Steel:

1. Through-wall flashing (mechanically keyed) sheets: ASTM A167, Type 304, soft annealed, minimum thickness 0.012 inch.
2. Fascia, exposed trims, reglets, roof drain flashings, base flashings, counter flashings, flashing receivers, drip edges, equipment support flashings, roof penetration flashings: ASTM A167, Type 304, hard tempered, minimum thickness 0.0187 inch, unless otherwise shown or indicated.

B. Miscellaneous Items:
1. Vinyl tape: As recommended by the metal product manufacturer as a dissimilar metal separator.
2. Wood blocking: Section 06100.
3. Bituminous Paint: As recommended by the manufacturer as a dissimilar metal separator.
4. Solder: ASTM B32, with flux-core; of the following solder alloys. Use another alloy if it is demonstrated to the AR that better results, including visual as applicable, can be achieved on the particular metals being joined.
   a. For stainless steel: Tin/silver solder, Alloy Grade Sn96, with acid flux of type recommended by stainless steel manufacturer.
   b. For copper: 50-50 tin/lead solder, Alloy Grade Sn50, with rosin flux. For lead-coated copper: 60-40 tin/lead solder, Alloy Grade Sn60, with rosin flux.
5. Sealant:
   a. Elastomeric: Section 07920.
   b. Epoxy Seam Sealer: Two-part, non-corrosive, aluminum seam-cementing compound as recommended by aluminum manufacturer for exterior and interior non-moving joints including riveted joints.
   c. Mastic Sealant: Polyisobutylene, non-hardening, non-skinning, nondrying, non-migrating sealant.
6. Metal Accessories and Fasteners: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching, matching finish of exposed heads, or compatible with material being installed as approved; noncorrosive; size and thickness required for performance per approved samples.
7. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.

2.02 FABRICATION, GENERAL

A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.

B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Form exposed sheet metal Work 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.

D. Expansion Provisions: Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in the Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints or intermeshing hooked flanges, not less than one-inch deep, filled with mastic sealant (concealed within the joints).

E. Fabricate nonmoving joints with flat-lock seams. For tin edges to be seamed, form seams and solder. For aluminum to be seamed, form seams and seal with epoxy seam sealer and rivet joints for additional strength as approved.

F. Sealed joints: Form movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

G. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

H. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.
   1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean dirt, debris, grease, oil and other foreign substances from surfaces that are to receive metalwork.

B. Existing sealant and backer rod are to be removed all sheet metal flashing/counter flashing locations and replaced with a joint protection assembly (sealant and backer rod) as specified in specification section 07920.

3.02 INSTALLATION

A. Coordinate flashing and sheet metal with the work of other trades. Shop-fabricate the work whenever possible. Provide for expansion and contraction of sheet metal.

B. Install the work of this Section in accordance with the NRCA Roofing and Waterproofing Manual, performance requirements, manufacturers' instructions and SMACNA's Architectural Sheet Metal Manual. Anchor units securely in place by methods indicated and conceal fasteners where possible. Set units true to line and level with exposed edges folded back to form hems. Install exposed sheet metal

without excessive oil canning, buckling and tool marks. Verify shapes and dimensions of surfaces to be covered prior to fabrication and trim to fit substrates. Install work with laps, joints and seams that will be permanently watertight and weatherproof. Provide for thermal expansion of metal units. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges not less than one-inch deep and fill with mastic sealant concealed within joints. Form non-expansion joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant. Use joint adhesive for non-moving joints specified not to be soldered. Fabricate non-moving seams in sheet metal with flat-lock seams, except fabricate non-moving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints as approved for additional strength. Tin edges to be seamed, form seams and solder.

C. Perform cutting, drilling and other operations in connection with sheet metal work to accommodate work of other trades. Provide accessories as recommended by SMACNA Architectural Sheet Metal Manual.

D. Where sheet metal abuts or interfaces with adjacent materials, join as shown on approved shop drawings. Isolate dissimilar metals by use of compatible coatings or other approved methods. Apply red-rosin paper backing for sheet metal applied to any surface to permit movement caused by expansion or to prevent galvanic action.

E. Soldering:
   1. Clean surfaces to be soldered to remove oils and foreign matter. Brush liberal amount of flux on seams, solder immediately, neutralize acid and clean.
   2. Solder slowly, thoroughly heating seam and completely sweating solder through full width of seam. Use ample solder for full width along seams.
   3. Do not solder aluminum and coil-coated galvanized steel sheet. Pre-tinning is not required for lead and lead-coated copper. Do not use torches for soldering, heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

F. Seams:
   1. Flat lock: 3/4-inch wide, minimum.
   2. Solder lap: One-inch wide, minimum
   3. Unsoldered plain lap: Three-inch wide, minimum.
   4. Seams: Corresponding to direction of flow.

G. Form flashings from material shown or specified made up from sheets eight to 10 feet long with locked and soldered seams into units of not more than 16 feet. Join units together with three-inch wide loose-locked seams filled with sealant before units are joined. Runs of flashing shorter than 16 feet will not require loose-seam joints. Miter corners and join by locked and soldered joints.

H. Where cants do not occur at intersections of roof decks and vertical surfaces of walls and other construction, provide flashings. Extend base flashings up vertical surfaces eight inches unless otherwise shown, behind metal cap flashing and out onto roof or horizontal surface not less than eight inches. Coat back sides of base flashing with bituminous paint and set into angle formed by roof and vertical surfaces after three plies of roofing-felt reinforcement have been laid. Nail flange with nails spaced three inches on centers and 3/4-inch from edge into wooden nailer provided in roof slab. Secure metal flashing at roof edges according to FM Loss Prevention Data Sheet 1-49 for specified wind zone.

I. Counter flashings: Coordinate installation of counter flashings with installation of assemblies to be protected by counter flashing. Install counter flashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counter flashing joints a minimum of 2 inches and bed with sealant.

J. Equipment Support Flashing: Coordinate equipment support flashing installation with roofing and equipment installation. Weld or seal flashing to equipment support member.

K. Install sealant in accordance with Sections 07920.

L. Install wood blocking in accordance with Section 06100.

3.03 CLEAN-UP

A. Clean up rubbish and debris caused by this work and remove from site.

B. Promptly remove drippings and stains of materials from exposed surfaces.

C. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

END OF SECTION

SECTION 07840
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

1.02 REFERENCE STANDARDS

A. FM 4991 - Approval of Firestop Contractors; Factory Mutual Research Corporation; 2001.

1.03 SUBMITTALS

A. Product Data: Provide data on product characteristics, performance ratings, and limitations.

C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Certificate from authority having jurisdiction indicating approval of materials used.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Approved by Factory Mutual Research under FM Standard 4991, Approval of Firestop Contractors , or meeting any two of the following requirements:.
   2. With minimum 3 years documented experience installing work of this type.
   3. Able to show at least 5 satisfactorily completed projects of comparable size and type.
   4. Licensed by authority having jurisdiction.

PART 2 PRODUCTS

2.01 FIRESTOPPING - GENERAL REQUIREMENTS

A. Manufacturers:
   1. A/D Fire Protection Systems Inc: www.adfire.com.

2. 3M Fire Protection Products: www.3m.com/firestop.
3. Hilti, Inc: www.us.hilti.com.
4. Specified Technologies, Inc: www.stifirestop.com.

B. Firestopping: Any material meeting requirements.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

2.02 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

A. Blank Openings:
   1. In Floors or Walls:
      a. 2 Hour Construction: UL System C-AJ-0090; Hilti FS-ONE Intumescent Firestop Sealant.

B. Penetrations Through Floors or Walls By:
   1. Multiple Penetrations in Large Openings:
      a. 3 Hour Construction: UL System C-AJ-1140; Hilti CP 637 Firestop Mortar.
      b. 3 Hour Construction: UL System C-AJ-8110; Hilti FS 657 Fire Block.
   2. Insulated Pipes:
      a. 3 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE Intumescent Firestop Sealant.
      b. 2 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE Intumescent Firestop Sealant.
      c. 2 Hour Construction: UL System C-AJ-5048; Hilti FS-ONE Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CP 601S Elastomeric Firestop Sealant, or CP 604 Self-Leveling Firestop Sealant.
   3. HVAC Ducts, Uninsulated:
      a. 2 Hour Construction: UL System C-AJ-7111; Hilti FS-ONE Intumescent Firestop Sealant.

C. Penetrations Through Floors By:
   1. Multiple Penetrations in Large Openings:
      a. 3 Hour Construction: UL System F-A-1023; Hilti CP 680-P/M Cast-In Device.
      b. 2 Hour Construction: UL System F-A-8012; Hilti CP 604 Self-Leveling Firestop Sealant.
   2. Uninsulated Metallic Pipe, Conduit, and Tubing:
      a. 2 Hour Construction: UL System F-A-1016; Hilti CP 680-P/M Cast-In Device.
   3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
      a. 2 Hour Construction: UL System F-A-2015; Hilti CP 643N Firestop Collar.
      b. 2 Hour Construction: UL System F-A-2053; Hilti CP 680-P Cast-In Device.
      c. 2 Hour Construction: UL System F-A-2058; HIlti FS-ONE Intumescent Firestop Sealant.
   4. Insulated Pipes:
      a. 2 Hour Construction: UL System F-A-5015; Hilti CP 680-P/M Cast-In Device.

b. 2 Hour Construction: UL System F-A-5017; Hilti CP 680-P/M Cast-In Device.

D. Penetrations Through Walls By:
1. Uninsulated Metallic Pipe, Conduit, and Tubing:
2. HVAC Ducts, Uninsulated:
a. 2 Hour Construction: UL System W-J-7109; Hilti FS-ONE Intumescent Firestop Sealant or CP 606 Flexible Firestop Sealant.
3. HVAC Ducts, Insulated:
a. 2 Hour Construction: UL System W-J-7112; Hilti FS-ONE Intumescent Firestop Sealant.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authority having jurisdiction.

C. Install labeling required by code.

3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

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SECTION 07920

JOINT SEALANTS

PART 1 GENERAL

1.01 SUMMARY

A. The work shall consist of providing the necessary labor, materials, equipment and supervision for placement of elastomeric sealant joints and joint backers installed as part of the work.

1.02 RELATED SECTIONS

A. Section 01400 – Quality Control and Assurance Requirements

B. Section 01550 – Access Roads, Parking Areas and Parking Controls

C. Section 01560 – Temporary Barriers and Closures

1.03 SUBMITTALS

A. Product Data: Provide data indicating sealant chemical characteristics.

B. Samples: Submit two samples, 6 inch in size illustrating sealant colors for selection.

1.04 QUALITY CONTROL INSPECTIONS

A. All quality control inspections and testing shall be performed by the Quality Control Engineer in accordance with this Section and Section 01400.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document covering installation requirements on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.06 JOB CONDITIONS

A. Contractor shall perform all work while maintaining vehicular parking to site and within site that are not under construction in accordance with Section 01550 and Contract Drawings.

B. Contractor shall provide adequate signalization in accordance with Section 01560 and Contract Drawings for all overhead and work areas below.

C. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.07 WARRANTY

A. Correct defective work within a five year period after Date of Substantial Completion.

B. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MATERIALS

A. Elastomeric Sealant for Concrete to Concrete and Concrete to Metal: Two part polyurethane with minimum ±50 percent movement capacity in conformance with ASTM C-920, Type M, Grade NS, Class 50 with compatible backer rod and primer. Submit color samples. Color to be selected by the Authority.

B. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

C. General Purpose Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 25, Uses M, G, and A; single component.

D. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.

E. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.

2.02 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width .

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

2.03 MANUFACTURERS

A. For level joints: Sikaflex 2C SL, two component, self-leveling, polyurethane elastomeric sealant, as manufacturer by Sika Corporation, 201 Polito Ave., Lyndhurst, NJ 07071, is considered to conform to the requirements of this specification.

B. For uneven joints: Sikaflex 2C NS, two component, non-sag, polyurethane elastomeric sealant, as manufacturer by Sika Corporation, 201 Polito Ave., Lyndhurst, NJ 07071, is considered to conform to the requirements of this specification.

C. Any materials required for repair prior to installation shall be manufactured by the same supplier of the proposed .

PART 3 EXECUTION

3.01 WORK TO BE PERFORMED

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

C. Sealants to be replaced/installed at the following locations:
1. Joints between flanges of concrete double tees.
2. Concrete double tee to concrete inverted tee joint.
3. Concrete double tee to concrete “L” beam joint.
4. Concrete double tee to parapet/spandrel wall panels.
5. Joints between parapet wall panels.
6. Concrete double tee flange to column interface.
7. Concrete double tee flange to shear wall interface.
8. Joints between tops of ramp walls.
9. Connection pockets as shown in Contract Drawings.
10. At all other areas where sealant joint exist.

D. Arrange a pre-installation conference with the sealant manufacturer’s representative, Quality Control Engineer and the AR to review site conditions, work procedures and to select primers.

E. Install samples of sealant material colors for review and selection by the AR. Do not purchase materials until approval of color is received from the AR.

3.02 SURFACE PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

E. Cut existing sealant material from joints and connection block-outs. Remove any existing backer rod or backer board.

F. Remove all debris.

G. Clean the sides of the joint as necessary to remove ail remnants of the existing sealant material that will inhibit bonding of the new sealant Follow the sealant manufacturer's recommendations for joint preparation and priming. Grind and dress concrete edges. Grind high side of concrete flush in elevation with opposite side.

H. Repair spalled areas in accordance with Contract Drawings.

3.03 SEALANT APPLICATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve the following , unless otherwise indicated:
   1. Width/depth ratio of 2:1.
   2. Neck dimension no greater than 1/3 of the joint width.
   3. Surface bond area on each side not less than 75 percent of joint width.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Tool joints concave.

G. Install an open cell backer rod system compatible with the sealant as recommended by the sealant manufacturer. Install bond breaker where joint backing is not used.

H. If a primer is required, sealant shall not be installed until the primer has cured.

I. The joints shall be dry when the sealant is installed.

J. The sealant shall be applied into the joint mechanically, with pressure to expel all air and provide complete filling of the joint to the backer rod. Surface pointing of flaws in the joint with a skin bead shall not be accepted. The joint surface shall be uniform and free of wrinkles.

K. All joints shall be neatly tooled to provide a concave surface profile.

L. No sealant shall be applied during adverse weather conditions or when temperatures are outside of the range of those recommended by the manufacturer.

M. Do not paint over sealant joints.

3.04 QUALITY CONTROL INSPECTIONS

A. The Quality Control Engineer shall inspect surface preparation, backer rod installation and primer application prior to sealant installation for compliance with this Section and the manufacturer's specifications.

B. The Quality Control Engineer shall inspect the completed joints for compliance with this Section, the manufacturer's specification and workmanship.

3.05 CLEANING

A. Surfaces or components adjacent to the sealed joints shall be cleaned free of smears or other soiling due to sealing operations as the work progresses.

3.06 PROTECTION

A. Protect sealants until cured.

END OF SECTION

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SECTION 07950

EXPANSION CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. Work of this section includes supply and installation of expansion joint systems as indicated in the Contract Drawings. Included in this work shall be the preparation of the surface to receive the expansion joint, including preparation and concrete repair at expansion joints, and block-outs to receive joint systems and removal of existing expansion joints.

1.02 RELATED SECTIONS

A. Section 01400 – Quality Control and Assurance Requirements

B. Section 03010 – Maintenance of Concrete

1.03 QUALITY ASSURANCE

A. All field quality control inspections shall be performed by the Quality Control Engineer in accordance with this Section and Section 01400.

B. Pre-installation Conference: The manufacturer's representative shall visit the site prior to the expansion joint installation to review site conditions and preparation for the joint installation. The Contractor, Quality Control Engineer and AR shall be present at the pre-installation conference. The Manufacturer's Representative shall document his observations and recommendations in a site visit report. The site visit report is to be delivered within five working days after completion of the site visit. Copies of the report shall be provided to the Quality Control Engineer and the AR.

C. The manufacturer's representative shall visit at least four separate times during the project to observe continued installation of the expansion joint system. The Manufacturer's Representative shall document his observations and recommendations in a site visit report prepared for each visit. The site visit report is to be delivered within five working days after completion of the site visit. Copies of the report shall be provided to the Quality Control Engineer and the AR.

1.04 SUBMITTALS

A. Product Data: Submit product literature and installation instructions.

B. Samples: Submit samples of specified expansion joint system, joint splices, prefabricated joint components and transitions and all other components of the system.

C. Shop Drawings: The manufacturer shall supply shop drawings for expansion joints. Specific shop drawings details shall be supplied for expansion joints at the following locations:
   1. Expansion joint/wall/column intersection with gland terminations at vertical wall surfaces.
   2. Expansion joint/parapet wall/column intersection with gland termination at vertical wall surfaces and vertical parapet wall surfaces.
   3. Expansion joint intersections with curbs.
   4. Transitions between expansion joint gland materials at horizontal and vertical wall surfaces.
   5. All expansion joint terminations.

D. Warranty:
   1. Upon completion of the project, submit a comprehensive joint warranty of the expansion joint system in decks and walls, executed by the Contractor and the Manufacturer of the specified system to cover labor and materials, for a period of five (5) years.
   2. The joint warranty shall insure the performance of the expansion joint system when installed in accordance with manufacturer's directions. free of defect including:
      a. Adhesive failure.
      b. Cohesive failure.
      c. Weathering, abrasion or tear failure from normal use.
      d. Waterproofing failure.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Materials shall be delivered in original sealed containers, clearly marked with the supplier's name, brand name, and type of material. All materials shall be accompanied by the proper MSDS forms, as required.

B. Storage and Handling: Recommended material storage temperature is 75"F. Handle products in such a manner as to avoid damage to container. Do not store for extended periods of time in direct sunlight.

C. Shelf life/Lot Numbers: Manufacturers shall provide dated lot numbers with projected expiration dates of appropriate materials.

1.06 JOB CONDITIONS

A. Environmental Conditions:
   1. Do not proceed with application of material when deck temperature is below 40°F or above 90° F.
   2. Follow manufacturer's instructions and limitations on surface conditions.
   3. Do not apply material unless surface to receive expansion joints is clean and dry, or if precipitation is imminent.

B. Protection:

1. Ensure that all personnel have read and understand the information contained within the appropriate MSDS for all materials utilized. All personnel shall wear the required respiratory protection devices listed on the MSDS literature. If explosion proof electrical devices are required, ensure that all drills, fans, etc., are so equipped.

2. Protect surrounding areas, personnel, property, etc. from damage due to installation of specified system.
3. Ensure that all work areas are properly barricaded to discourage non-related traffic through work area.
4. Do not allow traffic on finished system for a period of at least 24 hours following completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thermaflex Watertight Parking Deck Joint System manufactured by Emseal or approved equal.

B. EMS-550 ElastoLok Membrane Sealing System manufactured by MM Systems or approved equal

2.02 MATERIALS

A. Expansion Joint Systems: Primary expansion joint for slab surfaces: Provide watertight expansion control system that is capable of accommodating multi-directional movement and vehicular traffic in an open parking structure. System shall consist of preformed thermoplastic rubber profiles with integral side flanges typically cast into a preformed block-out by means of utilizing manufacturer's ambient cure elastomeric concrete header. The preformed thermoplastic rubber profile shall be sized to accommodate the existing joint widths in the field. Provide thermoplastic rubber profile that is ADA compliant for incidental pedestrian foot traffic.

1. Provide seal profile as generally indicated in the Contract Drawings. Seal size shall be supplied to fit joint dimensions. Dimensions to be field verified by Contractor prior to ordering seals. Profile design shall incorporate integral side flanges exhibiting a pronounced serrated profile and factory punched holes that interlock the profile into the elastomeric header material. Provide factory fabricated transitions to accommodate changes in horizontal and vertical planes of installation. Material shall meet the physical properties indicated below:

Physical Properties	Test Method	Requirements
Shore A Hardness	D-2240	64 to 76
Tensile Strength	D-412	1,000 psi, Min.
Ultimate Elongation	D-412	400% Min.

2. Transition joint for use at column and parapet wall intersections: Provide manufacturer's preformed thermoplastic rubber profile and termination hardware to accommodate transitions indicated in the Contract drawings. Transition joint shall be compatible with primary expansion joint and provide a water tight transition.
3. Elastomeric Concrete Nosing: Provide manufacturer's standard elastomeric concrete nosing material and bonding agents compatible with preformed thermoplastic rubber profile.

B. Expansion Joint System in Walls:
1. Seal shall combine factory-applied, 15 Shore-A hardness, low-modulus silicone, and alternating vertical laminations of impregnated expanding foam sealant and closed cell (EVA) foam into a unified binary sealant system.
2. Expanding foam laminations to be open-cell (minimum 90% open-cell structure) polyurethane foam impregnated with a water-based, non-drying, polymer-modified acrylic. Impregnation density of uncompressed foam to be at least 8.4 and must not exceed 9.1 lbs./cu. ft. Impregnated foam laminations to have tested stability over temperature range from -40 degrees F to 185 degrees F according to ASTM C711. Expanding foam laminations to be compressed to approximately 25% of fully expanded dimension.
3. Silicone external color facing to be factory-applied to the foam while it is partially pre-compressed to a width greater than maximum joint extension and cured before final compression. Coating width to be a minimum of 1.75 -1.85 times the designed or field measured, joint gap width. When compressed to final supplied dimension, a bellows with distinct and uniform folds to handle movement must be created in the silicone coating. Color to be selected by AR from manufacturer's standard colors.
4. Seal shall be supplied pre-compressed to less than the joint size, packaged in shrink-wrapped lengths with a self-adhesive on one face. Depth of seal as recommended by manufacturer for joint width. End to end joins of consecutive lengths of material to be joined by mitering across the direction of expansion of the material and joined faces to be lightly "buttered" with liquid silicone. To obtain identical color sealant, use liquid silicone sealant supplied by manufacturer from same color batch as was used to form the bellows.
5. Sealing against the substrate to be achieved through a combination of the pressure-sensitive adhesive impregnation, and the back pressure of the expanding foam, as well as through the addition in the field of a corner bead of silicone tooled between the preformed silicone bellows and substrate. Liquid silicone for corner beads to be supplied by the sealant manufacturer from the same color batch as was used to form the silicone bellows.
6. Submittal will include certification from manufacturer that the expanding foam impregnation will not any time bleed, stain, or otherwise contaminate the substrate so as to adversely affect future adhesion of sealants in the joint area. Submittal must include written certification from manufacturers of silicone and impregnated foam that the silicone and impregnation have been tested and are

compatible and that the silicone has good adhesion to the expanding foam laminations.

C. Expansion Joint Systems at Ramp Wall to Deck Surface: Provide watertight expansion control system that is capable of accommodating multi-directional movement and vehicular traffic in an open parking structure. System shall consist of a urethane gland. The urethane gland shall be sized to accommodate the existing joint widths in the field. Provide a urethane gland that is ADA compliant for incidental pedestrian foot traffic.
   1. Provide gland profile as generally indicated in the Contract Drawings. Gland size shall be supplied to fit joint dimensions. Dimensions to be field verified by Contractor prior to ordering gland. Material shall meet the physical properties indicated below:

Criteria	Test Method	Requirements
Movement Capability	ASTM C719	Minimum 15%
Tensile Strength	ASTM D412	Minimum 250 psi
Ultimate Elongation	ASTM D412	Minimum 450%
Hardness (Shore A)	ASTM C661	Minimum 15
Adhesion	ASTM C794	Minimum 50 lbs.

D. Concrete Impact Anchors: Diameter and length as indicated in the Contract Drawings. Drive pin type anchor with an aluminum/zinc alloy expanding body and Type 304 stainless steel drive pin.

E. Expansion joint transitions, vertical transitions, horizontal transitions and end terminations shall be factory fabricated to accommodate site conditions.

PART 3 EXECUTION

3.01 INSPECTION

A. Concrete: The Quality Control Engineer shall verify that the work done meets the following criteria:
   1. That the block-out surface is free of voids, air pockets and spalled edges.
   2. All concrete repair work adjacent to the joint and within the joint shall be completed in accordance with Section 03010.
   3. Factory fabricated components are supplied and installed in accordance with shop drawings.

3.02 PREPARATION

A. Concrete preparation, repair and concrete placement shall conform to Section 03010.

B. Spalls and unsound areas of concrete at the location of the expansion joint shall be removed to sound concrete and repaired. Repair procedures shall conform to specification Section 03010.

C. Sand Blasting: Horizontal and vertical concrete surfaces shall be lightly blasted to obtain a light-blast finish.

D. General: Area to receive expansion joint system shall be vacuumed and/or blown with compressive air to remove all dust and debris immediately prior to the application of the system.

E. Block-out dimensions must match the manufacturer's specification and tolerances.

3.03 APPLICATION

A. General:
   1. The expansion joint gland must be un-rolled and laid flat on a clean surface prior to the installation of the system. The purpose for this is to allow the gland to return to the normal orientation, relieving any "coiling" caused during shipment.

3.04 INSTALLATION

A. Expansion Joint System:
   1. Surface Preparation: Prepare the block-out recess. Remove existing expansion joint material including existing gland, sealants and steel hardware. The block-out must be clean, dry, and level. Unsound concrete shall be removed and the area repaired with the manufacturer's specified repair material. Sandblast the recess to remove laitance and contaminants. Taper off the edges of the recess.
   2. Clean the gland and place approximately 2 feet in the block-out recess - compressing it into the open joint. Continue to compress and insert the gland down the joint line to ensure proper compression of the gland and placement in the recess. Provide factory fabricated splices and corners where required.
   3. Once installed, the wings should be seated flat on the base of the recess. Clean the gland, prime and install bedding components in accordance with the manufacturer's specifications.
   4. Install elastomeric nosing material in accordance with the manufacturer's specifications.
   5. Install splices and terminations in accordance with the manufacturer's installation instructions.
   6. The Quality Control Engineer shall inspect the installation for general conformance with the manufacturer's specifications.

B. Expansion Joint System in Walls:
   1. Ensure joint faces are parallel and have sufficient depth to receive the full depth of the size of the sealant being installed plus at least ¼ inch for the application of corner beads where needed.
   2. Repair spalled, irregular or unsound joint surfaces and remove residues of old sealants and protruding roughness to ensure joint sides are smooth.
   3. Wire-brush or angle-grind to clean sides.

4. Wipe joint faces with lint-free rags dipped in toluene or other agent suitable for use on the substrate to ensure joint sides are free of dust, previous sealants, oils, grease, etc. Ensure joint sides are dry prior to installation.
5. Compare material width marked on each stick against joint width. Actual material width measured between hardboard will be slightly less than indicated joint width. If unsure of correct material selection, consult manufacturer.
6. The beginning end of the first stick and the final end of the last stick must be squared off. Miter the ends of all other consecutive lengths while still in the packaging using a power miter saw in accordance with the manufacturer's specifications.
7. The sealant is held under compression by hardboard and plastic wrapping. When ready to install, slit the plastic wrapping by cutting on the hardboard, discard hardboard and inner release liner. Do not cut along siiicone-coating face.
8. For packaging and production reasons, the silicone facing is coated in the factory with a release agent. Prior to installation, this agent must be wiped off using a solvent in order for the fillet beads to adhere to the silicone facing and to avoid contamination of the substrate. Lightly, quickly and thoroughly wipe the cured silicone facing with a lint-free rag made damp with toluene to remove the release agent.
9. Apply thin bead of sealant to mitered edge of silicone facing only. Use correct grade and color of sealant as supplied.
10. Peel off release paper to expose pressure-sensitive adhesive on one face of material. 'Feed' material into joint, working sequentially in one direction starting at the bottom of the joint. Always push material (do not pull it) to prevent stretching. (Start at bottom of wall and work up.) Recess 3/8" (9mm) from wall surface. Use a stiff-bladed putty knife to press the adhesive side of the material firmly against the substrate so that it will hold in place while it expands. If necessary, use small pieces of used hardboard packing as wedges to hold sections in place while they expand.
11. Insert first piece of material but leave mitered end protruding up and out of joint. Place mitered end next section against end of first piece leaving the mitered end protruding from joint. Insert the rest of this section material into joint. Finally push protruding mitered end sections into joints. Blend silicone bead to silicone facing.
12. Wait until material is expanded fully against both sides of the joint. Gun a caulking bead where the sealant facing meets the substrate. Tool the fillet bead firmly against the substrate and silicone facing.

C. Expansion joint System at Ramp Wall to Deck Surface:
   1. Surface Preparation: Installation must be performed in gap openings with sound clean and dry substrates. Gap openings must have parallel, dimensionally consistent side walls. Any loose portion of concrete at the gap must be removed and the concrete properly repaired as directed by the Quality Control Engineer.
   2. The concrete block-out edges must be clean and sound. The edges should be sandblasted or ground to remove laitance. Spot repairs must be completed prior to installation. Repair material must have adequate cure time before proceeding with joint installation.

3. Utilizing compressed air, remove any dust, or other contaminations, being certain that any high spots have been eliminated to ensure that the installed joints are slightly recessed from the concrete.
4. Roll out the pre-molded seal along side of the expansion joint blackout. Wire brush and clean the beveled edges with solvent Note: Pre-mold can shrink after being unrolled. Do not make any final cuts at this time.
5. Wipe stainless steel plates to remove any dirt or oil. Using either a brush or a rag, apply a thin film of primer to the stainless steel plate as per manufacturer's recommendations. Do not over prime. For maximum adhesion sandblasting or grinding is recommended prior to solvent wipe. Let dry for%- 2 hours.
6. Prime the block-out ledge where the bedding will be installed with primer. Allow the primer to dry until it is tacky to the touch.
7. Caulk and trowel a thin section of polyurethane sealant material onto the block-out. The bedding is intended to level the block-out so the plates will rest smooth and flat. Bedding must fully support the plate and provide for anticipated movement.
8. Lay a precut piece of polyethylene onto the fresh bedding to act as bond brake. Polyethylene sheet should not extend into the area that will receive the polyurethane sealant nosing later.
9. Bed the stainless steel plates; primed side down. Be certain to leave 1/8" to %" between each plate as work progresses down the length of the joint. Use a piece of pre-mold as a template to set plates to proper depth. Placement of plates within the block-out is determined by the temperature at the time of installation, and by the expected annual movement rating. Once in place, anchor plates into ramp wall with concrete impact anchors at 18” on center.
10. Tape visqueen over the top face of the plates to keep them free floating under the pre-mold sealant.
11. Place urethane gland into the block-out making sure that seal is centered in joint. Tape the edges of the pre-molded seal and the concrete at the edge of the block-out. Apply primer to the concrete and tapered pre-mold edge. Prime all butt splices at this time also.
12. All butt joints must be precut at a 90 degree angle, and then caulked tightly (1/8” or less) with polyurethane sealant to bond one piece of pre-mold to another. Apply polyurethane nosing in block-out and at plate termination as shown in the Contract Drawings.
13. Pull the tape from the pre-mold and concrete.
14. The Quality Control Engineer shall inspect the installation for general conformance with the manufacturer’s specifications.

3.05 COMPLETION

A. Cleaning: Remove debris resulting from work specified herein from project site.

END OF SECTION

SECTION 08110
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire-rated and Non-Fire Rated steel doors and frames.

1.02 RELATED SECTIONS

A. Section 08710 - Door Hardware.

1.03 REFERENCE STANDARDS

A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

B. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames; 2003.

C. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 1998 (R2004).

D. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2006.

E. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; 2007.

F. NAAM HMMA 862 – Guide Specification for Commercial Security Hollow Metal Doors and Frames.

G. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2010.

H. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc; current edition.

I. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets, specifications, and installation instructions.

B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any. Show details of each frame type, elevation and construction for each door type, conditions at openings, location for each door type, location and installation requirements for finish hardware (including cutouts and reinforcements), details of connections, and anchorage and accessory items.

C. Certificates: Provide certification that glazing meets safety impact requirements of CPSC 16 CFR 1201.

D. Warranties: Provide manufacturer/installer warranty.

1.05 QUALITY ASSURANCE

A. Provide doors and frames complying with ANSI/SDI A250.8 and as herein specified.

B. Fire Rated Assemblies: Wherever fire resistance classification is shown or scheduled for steel doors and frames, provide fire rated units that have been tested as fire door assemblies and comply with National Fire Protection Association (NFPA) Standard No. 80, are tested in accordance with NFPA 252 or UL 10B/UL 10C and UL 1784 as required by the NYC Building Code and comply with these Specifications. Identify each door and frame with metal UL, or Warnock Hersey labels indicating applicable fire class of the unit. Rivet or weld labels on the hinge edge of door and jamb rabbet of frame.

1.06 WARRENTY

A. Submit warranty signed by manufacturer and installer, agreeing to replace assemblies which fail in materials, performance or workmanship within the specified warranty period.

1. Warranty Period: 1 year from date of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with NAAMM HMMA 840.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

1.08 FIELD EXAMINATION

A. At the Site, before door installation, the Authority reserves the right to select at random one or more doors for examination by cutting a portion of such size to reveal the construction of the particular door.

1. If the examination finds that the doors examined do not comply with requirements of the Specifications, all doors shall be removed from the Site and new doors shall be provided. Costs of examination and replacement of rejected doors shall be borne by Contractor.

2. If the examination finds that the doors do comply with the requirements of the Specifications, the cost of the examination and the cost of the replacement of the examined doors will be borne by the Authority.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Doors and Frames:
   1. Assa Abloy Ceco, Curries, or Fleming: www.assaabloydss.com.
   2. Republic Doors: www.republicdoor.com.
   3. Steelcraft: www.steelcraft.com.
   4. Approved equal.

2.02 DOORS AND FRAMES

A. All hollow metal doors and frames shall comply with NAAMM, HMMA 862, Requirements for All Doors and Frames shall include the following:
   1. Accessibility: Comply with ANSI/ICC A117.1.
   2. Door Top Closures: Flush with top of faces and edges.
   3. Door Edge Profile: Beveled on both edges.
   4. Door Texture: Smooth faces.
   5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
   6. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
   7. Galvanizing for all doors and frames: Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A526, G60 zinc coating, mill phosphatized.
   8. Shop Painting:
      a. Clean, treat and paint exposed surfaces of steel door and frame units, including galvanized surfaces.
      b. Chemically clean steel surfaces of mill scale, rust, oil, grease, dirt and other foreign materials before application of paint.
      c. Apply phosphate conversion pretreatment coating.
      d. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint. Apply primer immediately after surface preparation and pretreatment.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 DOORS

A. Fire Rated Doors:
   1. Where fire-rated door and frame assemblies are required for code compliance, or are otherwise indicated, provide door, frame and hardware assemblies in compliance with NFPA 80, which are labeled and listed by UL.
   2. Fabrication and assembly requirements necessary to obtain labels will take precedence over requirements shown or specified, except where requirements shown or specified exceed sizes or gauges required for labeling.
   3. Where oversized fire doors are required, furnish manufacturer's certification that assembly has been constructed with materials and methods equivalent to labeled construction.
   4. Louvers: Equip louvers in fire-rated doors with UL-listed self-closing fire dampers with fusible links.
   5. Identify each fire door and frame with permanent UL labels, indicating the applicable fire rating of both the door and the frame. Secure labels to vertical edge of doors and frames where readily visible. Protect labels from painting operations.

B. Exterior Doors
   1. Fabricate exterior doors with two (2) outer stretcher-leveled, galvannealed steel sheets of 14 gage unless indicated otherwise on the Drawings. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces and stile edges, except around glass and louver panels. On mortise face of door, vertical joints shall be continuously welded and ground smooth and coated with zinc-rich primer.
   2. Provide reinforcement for surface sheet, edge, hardware, stops, and other provisions, of size and gage as detailed on Drawings.
   3. Provide 14 GA bottom channel and top channel and closure, as detailed on Drawings.

2.04 STEEL FRAMES

A. Exterior Door Frames, Fire-Rated: Knock-down type.
   1. Fire Rating: Same as door, labeled.
   2. Finish: Factory primed, for field finishing.

2.05 ACCESSORY MATERIALS

A. Grout for Frames: Portland cement grout of maximum 4-inch slump for hand troweling; thinner pumpable grout is prohibited.

B. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

C. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

2.06 FINISH MATERIALS

A. Primer: Rust-inhibiting, complying with ANSI A250.10 , door manufacturer's standard.

B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.02 INSTALLATION

A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.

B. In addition, install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

E. Coordinate installation of hardware.

3.03 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.04 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

END OF SECTION

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SECTION 08120
ALUMINUM DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tubular aluminum doors.

B. Aluminum door frames.

C. Accessories, including louvers, fasteners, and brackets.

1.02 RELATED SECTIONS

A. Section 07920 - Joint Sealants.

B. Section 08710 - Door Hardware.

C. Section 08800 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA 609 - Voluntary Guide Specification for Cleaning and Maintenance of Architectural Anodized Aluminum; American Architectural Manufacturers Association; 2009.

B. AAMA 701/702 - Voluntary Specifications for Pile Weatherstripping and Replaceable Fenestration Weatherseals; American Architectural Manufacturers Association; 2004.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; American Architectural Manufacturers Association; 2005

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2009.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2008.

F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2007.

1.04 SUBMITTALS

A. Product Data: Manufacturer's descriptive literature for each type of door; include information on fabrication methods.

B. Shop Drawings: Include elevations of each opening type.

C. Selection Samples: Complete set of color and finish options, using actual materials, for Architect's selection.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Not less than 5 years of experience in manufacturing components of the types specified.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide products complying with specified requirements and manufactured by one of the following:
   1. Cline Aluminum Doors, Inc: www.clinedoors.com .
   2. Wilson Partitions: www.wilsonpart.com .
   3. Kawneer, www.kawneer.com.
   4. Or approved equal.

2.02 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), alloy 6063-T5 or alloy 6463-T5.

2.03 COMPONENTS

A. Tubular Aluminum Doors: Provide 1-3/4 in thick glazed doors using materials as follows:
   1. Framing: Extruded aluminum tubing, 0.125 in minimum thickness, with heavy-duty plated steel through bolts in rails.
      a. Stile Width: Nominal 5 inches.
   2. Glazing: As specified in Section 08800 - Glazing.

B. Aluminum Door Frames: Provide frames sized to fit wall thicknesses indicated on the drawings, in profiles indicated, and constructed from materials as follows:
   1. Frame Members: Extruded aluminum shapes, not less than 0.062 inch thick, reinforced at hinge and strike locations.
   2. Corner Brackets: Extruded aluminum, fastened with stainless steel screws.
   3. Trim: Extruded aluminum, not less than 0.062 inch thick, removable snap-in type without exposed fasteners.
   4. Replaceable Weatherstripping: AAMA 701/702 wool pile.

2.04 FINISHES

A. Finish: High Performance Organic Coating: Kynar/Polyvinylidene Fluoride (PVDF) complying with requirements of AAMA 2604; color as selected from manufacturer's full range by AR.

2.05 FABRICATION

A. Door sizes shown are nominal; provide standard clearances as follows:

1. Hinge and Lock Stiles: 0.125 inch.
2. Between Meeting Stiles: 0.250 inch.
3. At Top Rail and Bottom Rail: 0.125 inch.

B. Aluminum frames: Sizes and contours as indicated on drawings.

2.06 ACCESSORIES

A. Fasteners: Aluminum, non-magnetic stainless steel, or other material warranted by manufacturer as non-corrosive and compatible with aluminum components.

B. Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible, otherwise, non-magnetic stainless steel or steel hot-dip galvanized in compliance with ASTM A123/A123M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall surfaces and openings are ready to receive frames and are within tolerances specified in manufacturer's instructions.

B. Verify that frames installed by other trades for installation of doors of this section are in strict accordance with recommendations and approved shop drawings and within tolerances specified in manufacturer's instructions.

3.02 PREPARATION

A. Perform cutting, fitting, forming, drilling, and grinding of frames as required for project conditions.

B. Replace components with damage to exposed finishes.

C. Separate dissimilar metals to prevent electrolytic action between metals.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and approved shop drawings.

B. Set frames plumb, square, level, and aligned to receive doors. Anchor frames to adjacent construction in strict accordance with manufacturer's recommendations and within specified tolerances.

C. Where aluminum surfaces contact metals other than stainless steel, zinc, or small areas of white bronze, protect from direct contact by painting dissimilar metal with heavy coating of bituminous paint.

D. Hang doors and adjust hardware to achieve specified clearances and proper door operation.

3.04 CLEANING

A. Upon completion of installation, thoroughly clean door and frame surfaces in accordance with AAMA 609.

B. Do not use abrasive, caustic, or acid cleaning agents.

3.05 PROTECTION

A. Protect products of this section from damage caused by subsequent construction until substantial completion.

B. Replace damaged or defective components that cannot be repaired to a condition indistinguishable from undamaged components.

END OF SECTION

SECTION 08710
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for hollow steel and aluminum doors.

B. Hardware for fire-rated doors.

C. Lock cylinders for doors for which hardware is specified in other sections.

D. Thresholds.

E. Weather-stripping, seals and door gaskets.

1.02 RELATED SECTIONS

A. Section 08110 - Hollow Metal Doors and Frames.

B. Section 08120 - Aluminum Doors and Frames

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Rule; 2010; (ADA Standards for Accessible Design).

B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

C. BHMA A156.3 - American National Standard for Exit Devices; Builders Hardware Manufacturers Association; 2001 (ANSI/BHMA A156.3).

D. BHMA A156.4 - American National Standard for Door Controls - Closers; Builders Hardware Manufacturers Association, Inc. ; 2000 (ANSI/BHMA A156.4).

E. BHMA A156.6 - American National Standard for Architectural Door Trim; Builders Hardware Manufacturers Association; 2005 (ANSI/BHMA A156.6).

F. BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders; Builders Hardware Manufacturers Association, Inc.; 2005 (ANSI/BHMA A156.8).

G. BHMA A156.13 - American National Standard for Mortise Locks & Latches; Builders Hardware Manufacturers Association ; 2005 (ANSI/BHMA A156.13).

H. BHMA A156.18 - American National Standard for Materials and Finishes; Builders Hardware Manufacturers Association, Inc.; 2006 (ANSI/BHMA A156.18).

I. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems, Builders Hardware Manufacturers Association; 2005 (ANSI/BHMA A156.22).

J. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2010.

K. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2012.

L. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products onto which door hardware will be installed.

B. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

C. Convey Owner's keying requirements to manufacturers.

1.05 SUBMITTALS

A. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project.

B. Hardware Schedule: Detailed listing of each item of hardware to be installed on each door. Use door numbering scheme as included in the Contract Documents.

C. Keying Schedule: Submit for approval of Owner.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

E. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

F. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

G. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

H. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

I.. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.

1.06 QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

1.08 WARRANTY

A. Provide five year warranty for all hardware.

PART 2 PRODUCTS

2.01 DOOR HARDWARE - GENERAL

A. Provide all hardware specified or required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated. All hardware

B. Provide all items of a single type of the same model by the same manufacturer.

C. Provide products that comply with the following:
   1. Applicable provisions of federal, state, and local codes.
   2. ANSI/ICC A117.1, American National Standard for Accessible and Usable Buildings and Facilities.
   3. Applicable provisions of NFPA 101, Life Safety Code.
   4. Fire-Rated Doors: NFPA 80.
   5. All Hardware on Fire-Rated Doors : Listed and classified by UL as suitable for the purpose specified and indicated.
   6. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide hardware that enables door assembly to comply with air leakage requirements of the applicable code.

D. Finishes: All door hardware the same finish unless otherwise indicated.
   1. Primary Finish: Shall match existing or be Satin chrome plated over nickel on brass or bronze, 630.
   2. Finish Definitions: BHMA A156.18.

2.02 HINGES

A. Hinges: Provide hinges on every swinging door.
   1. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
   2. Provide ANSI/BHMA A156.1, Type A156.1, finish 630, full mortise butt hinges, anti-friction bearings, button tips.
   3. Provide hinges in the quantities indicated.
   4. Provide non-removable pins on exterior outswinging doors.

B. Quantity of Hinges Per Door:
   1. Doors From 60 inches High up to 90 inches High: Three hinges.

C. Manufacturers - Hinges:
   1. Assa Abloy McKinney: www.assaabloydss.com.
   2. Bommer Industries, Inc: www.bommer.com.
   3. C. R. Laurence Co., www.crlaurence.com.
   4. Hager Companies: www.hagerco.com.
   5. Stanley Black & Decker: www.stanleyblackanddecker.com.
   6. Or approved equal.

2.03 PUSH/PULLS

A. Push/Pulls: Comply with BHMA A156.6.
   1. Provide push and pull on doors not specified to have lockset, latchset, exit device, or auxiliary lock.
   2. Push/Pull hardware shall match existing hardware finish and size.

B. Manufacturers - Push/Pulls:
   1. Assa Abloy McKinney: www.assaabloydss.com .
   2. C. R. Laurence Co., Inc: www.crlaurence.com .
   3. Hager Companies: www.hagerco.com.
   4. Or approved equal.

2.04 LOCKS AND LATCHES

A. Locks: Provide a lock for every door, unless specifically indicated as not requiring locking.
   1. Hardware Sets indicate locking functions required for each door.
   2. If no hardware set is indicated for a swinging door provide an office lockset.
   3. Trim: Provide lever handle or pull trim on outside of all locks unless specifically stated to have no outside trim.
   4. Lock Cylinders: Provide key access on outside of all locks unless specifically stated to have no locking or no outside trim.

B. Lock Cylinders: Manufacturer's standard tumbler type, six-pin standard core.
   1. Provide cams and/or tailpieces as required for locking devices required.

C. Keying: Grand master keyed.
   1. Key to existing keying system.

D. Latches: Provide a latch for every door that is not required to lock, unless specifically indicated "push/pull" or "not required to latch".

2.05 MORTISE LOCKSETS

A. Locking Functions: As defined in BHMA A156.13.

B. Manufacturers - Mortise Locksets:
   1. Assa Abloy Corbin Russwin, Sargent, or Yale: www.assaabloydss.com.
   2. Corbin Russwin, www.corbinrusswin.com,
   3. Best Access Systems, division of Stanley Security Solutions: www.bestlock.com.
   4. Hager Companies: www.hagerco.com.
   5. Schlage: www.schlage.com.
   6. Or approved equal.

2.06 EXIT DEVICES

A. Locking Functions: Functions as defined in BHMA A156.3, and as follows:
   1. Entry/Exit, Always-Unlocked: Outside lever unlocked, no outside key access, no latch holdback.

B. Manufacturers:

1. Assa Abloy Corbin Russwin, Sargent, or Yale: www.assaabloydss.com .
2. C. R. Laurence Co., Inc : www.crlaurence.com.
3. Detex Corporation: ADVANTEX Series: www.detex.com.
4. DORMA Group North America: www.dorma-usa.com/usa.
5. Hager Companies: www.hagerco.com.
6. Or approved equal.

2.07 CLOSERS

A. Closers: Complying with BHMA A156.4.
   1. Provide surface-mounted, door-mounted closers unless otherwise indicated.
   2. Provide a door closer on every exterior door.
   3. Provide a door closer on every fire- and smoke-rated door. Spring hinges are not an acceptable self-closing device unless specifically so indicated.
   4. On pairs of swinging doors, if an overlapping astragal is present, provide coordinator to ensure the leaves close in proper order.

B. Manufacturers - Closers:
   1. Assa Abloy Corbin Russwin, Norton, Rixson, Sargent, or Yale: www.assaabloydss.com.
   2. C. R. Laurence Co., www.crlaurence.com.
   3. DORMA Group North America: www.dorma-usa.com/usa.
   4. Or approved equal.

2.08 STOPS AND HOLDERS

A. Stops: Complying with BHMA A156.8; provide a stop for every swinging door, unless otherwise indicated.
   1. Provide wall stops, unless otherwise indicated.
   2. If wall stops are not practical, due to configuration of room or furnishings, provide overhead stop.
   3. Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop unless specifically so stated.

B. Floor Stops:

C. Manufacturers - Wall and Floor Stops/Holders:
   1. Assa Abloy McKinney: www.assaabloydss.com.
   2. C. R. Laurence Co., www.crlaurence.com.
   3. Hager Companies: www.hagerco.com.
   4. Hiawatha, Inc: www.hiawathainc.com.
   5. Triangle Brass Manufacturing Co., Inc: www.trimcobbw.com.
   6. Or approved equal.

2.09 GASKETING AND THRESHOLDS

A. Gaskets: Complying with BHMA A156.22.

1. On each door in smoke partition, provide smoke gaskets; top, sides, and meeting stile of pairs. If fire/smoke partitions are not indicated on drawings, provide smoke gaskets on each door identified as a "smoke door" and 20-minute rated fire doors.
2. On each exterior door, provide weatherstripping gaskets, unless otherwise indicated; top, sides, and meeting stiles of pairs.
   a. Where exterior door is also required to have fire or smoke rating, provide gaskets functioning as both smoke and weather seals.
3. On each exterior door, provide door bottom sweep, unless otherwise indicated.

B. Thresholds:
1. At each exterior door, provide a threshold unless otherwise indicated.

C. Manufacturers - Gasketing and Thresholds:
1. Assa Abloy McKinney: www.assaabloydss.com.
2. Hager Companies: www.hagerco.com.
3. National Guard Products, Inc: www.ngpinc.com.
4. Pemko Manufacturing Co: www.pemko.com.
5. Zero International, Inc: www.zerointernational.com.
6. Or approved equal.

2.10 KEY CONTROLS

A. Key Management System: For each keyed lock on project, provide one set of consecutively numbered duplicate key tags with hanging hole and snap catch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive work; labeled, fire-rated doors and frames are present and properly installed, and dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Install hardware on fire-rated doors and frames in accordance with code and NFPA 80.

D. Mounting heights for hardware from finished floor to center line of hardware item: As listed in Schedule, unless otherwise noted.

3.03 ADJUSTING

A. Adjust hardware for smooth operation.

3.04 PROTECTION

A. Do not permit adjacent work to damage hardware or finish.

END OF SECTION

SECTION 08800
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass.

B. Glazing compounds and accessories.

1.02 RELATED SECTIONS

A. Section 08110 - Hollow Metal Doors and Frames.

B. Section 08120 - Aluminum Doors and Frames

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2011.

E. ASTM C1036 - Standard Specification for Flat Glass; 2006.

F. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass; 2004.

G. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Building; 2009a.

H. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

I. GANA (GM) - GANA Glazing Manual; Glass Association of North America; 2009.

J. GANA (SM) - FGMA Sealant Manual; Glass Association of North America; 2008.

1.04 SUBMITTALS

A. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

B. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

C. Samples: Submit two samples 6x6 inch in size of glass units.

D. Manufacturer's Certificate: Certify that glass meets or exceeds specified requirements.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual and FGMA Sealant Manual for glazing installation methods.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. Sealed Insulating Glass Units: Provide a five (5) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

PART 2 PRODUCTS

2.01 GLAZING TYPES

A. Type E-1 – Single exterior vision glazing:
   1. Application(s): Vision glazing at aluminum curtain wall and aluminum doors.
   2. Type: Annealed float glass
   3. Tint: Clear or to match existing.
   4. Total Thickness: ¼: inch.

B. Type S-2 - Fire-Rated Safety Glazing:
   1. Applications: Provide this type of glazing in the following locations:
      a. Glazed lites in fire doors.
   2. Fire Rating: As indicated on the drawings.
   3. Thickness: Laminated 5/16 inch.

2.02 EXTERIOR GLAZING ASSEMBLIES

A. Structural Design Criteria: Select type and thickness to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with ASCE 7.
   1. Use the procedure specified in ASTM E1300 to determine glass type and thickness.
   2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
   3. Thicknesses listed are minimum.

2.03 GLASS MATERIALS

A. Float Glass Manufacturers:
   1. Guardian Industries Corp: www.sunguardglass.com.
   2. Pilkington North America Inc: www.pilkington.com/na.
   3. PPG Industries, Inc: www.ppgideascapes.com.
   4. TPG Fire Glass, www.fireglass.com
   5. Or approved equal.

B. Float Glass: All glazing is to be float glass unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
   2. Heat-Strengthened and Fully Tempered Types: ASTM C1048.
   3. Tinted Types: Color and performance characteristics as indicated.
   4. Thicknesses: As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.

C. Laminated Fire Rated Ceramic Glass: UL- or WH-listed as fire-protection-rated glazing and complying with 16 CFR 1201 test requirements for Category II with or without the use of a surface-applied film.

2.04 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness, ASTM C864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness, ASTM C 864 Option I. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper. Size to match existing Glazing System.

D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option I; color to match existing.

E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

3.03 GLAZING METHODS

3.04 INSTALLATION - EXTERIOR/INTERIOR DRY METHOD (GASKET GLAZING)

A. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

3.06 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; does not mark heat absorbing or reflective glass units.

END OF SECTION

SECTION 09900

PAINTING AND COATING

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies furnishing and applying paint at the site.
   1. Specific surfaces and areas which require field painting and required paint systems are listed in the schedule of painting.
   2. Unless an item is shown not to be field painted or specified otherwise paint it in accordance with these specifications and Section 05500.

B. Definitions:
   1. Paint: Includes primers and undercoaters, sealers, paint, epoxy and special coatings.

C. Items Not Included In Field Painting:
   1. Stainless steel, ornamental metals, glass, resilient tile, ceramic tile, paving, acoustical tile, plastic laminate and similar items which are prefinished.
   2. Mill, factory and shop-applied primers and finishes.
   3. Corrosion-resistant structural steel, ASTM A242.
   4. High-strength structural corrosion-resistant steel shapes, plates and bars, ASTM A588.
   5. Galvanized-metal surfaces except fire stand pipes.
   6. UL labels on fire-rated doors and frames.

1.02 RELATED SECTIONS

A. Section 05500 – Metal Fabrications

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency ; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2011.

C. GreenSeal GS-11 - Paints 1993.

1.04 SUBMITTALS

A. Product Data: Provide complete list of all products to be used, with the following

information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
2. MPI product number (e.g. MPI #47).
3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

B. Submit the following for approval in accordance with the General Requirements and with the additional requirements as specified for each:

4. Samples:
   a. Three each of each color and texture, with identification of materials keyed to those specified and application methods.
   b. Samples of paint scheduled for application to smooth finishes applied to 12-inch square hardboard or metal panels.
   c. Samples of paint scheduled for application to concrete masonry units applied to 16-inch square by two-inch thick panel of concrete masonry units, including one tooled masonry joint. Subdivide panel to define prime or filler, intermediate and finish coats.

1.05 QUALITY ASSURANCE

A. Codes, Regulations, Reference Standards and Specifications:

1. ASME: A13.1.
2. ANSI: Z535.1.
3. ASTM: A242, A588, B117, C476, C920.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum five years documented experience.

C. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver products to the jobsite in their original unopened containers clearly labeled with the manufacturer's name and brand designation, referenced specification number and type, as applicable.

B. Store products in an approved ventilated dry area, protect from contact with soil and from exposure to the elements. Always keep products dry. Do not allow paint to freeze.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

D. Handle products in a manner that will prevent breakage of containers and damage to

products.

1.07 JOB CONDITIONS

A. Environmental Requirements:
   1. Do not apply paint to non-protected surfaces in wet weather or to surfaces on which ice, frost, water or dampness is visible.
   2. Do not apply exterior paint when the temperature is below 40F or expected to fall below this temperature. Do not apply interior paint when the temperature is lower than 60F or expected to fall below this temperature.
   3. Avoid painting steel which is at a temperature which can cause blistering, porosity, or otherwise be detrimental to the life of the paint. When paint is applied in hot weather or thinned in cold weather ensure that the specified thickness of paint coating is obtained.
   4. Do not apply paint in rain, wind, snow, fog or mist or when the steel surface temperature is below the dew point, resulting in condensation of moisture.
   5. Do not apply interior paint when, in the AR's opinion, satisfactory results cannot be obtained due to high humidity and excessive temperature; however, failure of the AR to notify the Contractor of the conditions will not relieve the Contractor of responsibility to produce satisfactory results.
   6. Provide lighting level of 80 ft. candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 GENERAL

A. To the maximum extent practicable, use the materials of one manufacturer throughout the project. No claims as to the suitability of a material specified, or of inability to produce first-class work with these materials, will be considered unless such claims are made in writing and submitted with the Contractor’s Bid Proposal.

B. Provide a primer suitable for each substrate type and which is manufactured or recommended by the paint manufacturer as part of a complete painting system.

C. Previously Primed Surfaces:
   1. If surfaces have been primed off-site at the mill, factory or shop, omit specified primer, but only if the off-site primer is acceptable to the paint system manufacturer for best performance of the specified paint system.
   2. For touch-up of off-site primer, use primer of the same composition as the mill, factory or shop primer.
   3. VOC Requirements: Provide products in compliance with local volatile organic compound regulations. If the listed product of a manufacturer does not comply, provide an accepted equivalent product which does comply.

D. Listed materials are a guide to quality intended. Substitute materials and paint systems acceptable to the AR, as an equal or of superior quality for each intended use, may be used in the work at no additional cost to the Authority.

E. Accessory Materials:
   1. General: Provide miscellaneous materials and accessories, whether listed or not, as necessary to complete the work in an approved manner.
   2. Caulk: Single-component, chemically curing, synthetic rubber, non-sag, ASTM C920, Type S, NS, Class 25.
   3. Spackling compound: Ready-mixed type, U.S. Gypsum Ready-Mixed Joint Compound - Topping, ASTM C476 or equal.
   4. Thinner: As recommended by the paint manufacturer.

2.02 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.

C. Paints:
   1. Glidden Professional: www.gliddenprofessional.com.
   2. Benjamin Moore & Co: www.benjaminmoore.com.
   3. Parker Paint Mfg. Co Inc., a Comex Group company: www.parkerpaint.com.
   4. PPG Architectural Finishes, Inc.: www.ppgaf.com.
   5. Pratt & Lambert Paints: www.prattandlambert.com.
   6. Sherwin-Williams Company: www.sherwin-williams.com.
   7. Or approved equal.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
   1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Supply each coating material in quantity required to complete entire project's work from a single production run.
   3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
   4.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content:
   1. Provide coatings that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

D. Chemical Content: The following compounds are prohibited:
   1. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
   2. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.

E. Flammability: Comply with applicable code for surface burning characteristics.

F. Colors: To be selected from manufacturer's full range of available colors.
   1. Selection to be made by Architect after award of contract.

2.03 PAINT SYSTEMS – EXTERIOR

A. New and Existing Ferrous Metals.
   1. 1st Coat - Touch up with epoxy Polyamide Paint.
   2. 2nd Coat - Polyamide Epoxy Paint applied at the rate of 4.0 to 6.0 Mils DFT.
   3. SSPC-PS Guide 13.01
      3rd Coat (Top Coat) - Acrylic Aliphatic
      Polyurethane applied at rate of 1.5 to 2.0 Mils DFT. SSPC-PS Guide 17.00 Type 5.

B. Zinc Coated Metal Exposed to Public View.

   Provide for all galvanized surfaces (Zinc metallizing) exposed to public view (not just on the exposed face), except chain link fences**:**
   1. 1st Coat - Epoxy polyamide -- 4.0 Mils DFT.
   2. 2nd Coat - Exterior Aliphatic polyurethane semi-gloss enamel -- 4.0 Mils DFT.

C. Existing steel members embedded in masonry or concrete.

1. 1st Coat - Epoxy polyamide equal to Tnemec Series 135 Chembuild (capable of painting on an SSPC-SP3 surface prep. -- 7 to 9 Mils DFT

D. Existing steel members exposed to view or the elements.

1. Provide the epoxy coat system, except the first coat shall be an Epoxy polyamide equal to Tnemec Series 135 Chembuild (capable of painting on an SSPC-SP3 surface prep.

E. Epoxy Coat System.

1. 1st Coat - (Primer) – Epoxy organic zinc rich Primer with 85% zinc applied at rate of -- 2.0 to 4.0 Mils. DFT. SSPC-PS Guide 12.00 (Organic Zinc Rich)
2. 2nd Coat - Polyamide Epoxy Paint applied at the rate of 4.0 to 6.0 Mils DFT. SSPC-PS Guide 13.01
3. 3rd Coat (Top Coat) - Acrylic Aliphatic Polyurethane applied at rate of 1.5 to 2.0 Mils DFT. SSPC-PS Guide 17.00 Type 5.

   For factory painted items, Manufacturer/Fabricator shall provide touch-up paint in sufficient amount for Project. -- 5.0 Mils DFT

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Plaster and Stucco: 12 percent.
   3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
   4. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATORY WORK

A. Inspect surfaces for their suitability to receive a finish. In the event that imperfections due to materials or workmanship appear on surfaces, make the appropriate corrections at no additional cost to the Authority. Correct damage to painted or decorated finishes due to carelessness or negligence of other trades.

B. Protect hardware, hardware accessories, plates, lighting fixtures and similar items installed prior to painting; remove protection upon completion of each space. Where necessary to remove installed products to ensure their protection, arrange for removal and reinstallation by mechanics of the trade involved. Disconnect equipment adjacent to walls; where necessary, move to permit painting of wall surfaces, and following completion of painting, replace and reconnect.

C. Clean surfaces to be painted as necessary to remove dust and dirt. Sand as necessary to properly prepare surfaces to receive paint or varnish.

D. Wash metal surfaces with benzine or mineral spirits to remove dirt, oil or grease before applying paint. Where rust or scale is present, wire brush or sandpaper clean before painting.

E. Prepare masonry surfaces to be painted by removing dirt, dust, oil and grease stains and efflorescence. The method of surface preparation is at the discretion of the Contractor provided that the results are approved. Clean masonry and plaster surfaces to be painted until they are free from alkali and thoroughly dry before applying paint. Test masonry and plaster surfaces for alkali, using red litmus paper, prior to painting.

F. Clean concrete surfaces free from dirt, or film left from form oil or concrete curing compounds, or loose or excess mortar. Steam clean or wash the surfaces with water. Use cleaning additive with discretion, in accordance with paint manufacturer's recommendation and to the satisfaction of AR.

G. Cut out cracks, scratches and other imperfections in plaster surfaces as required, fill with spackling compound and sand flush with adjacent surface. Fill voids in concrete with cement grout before painting.

H. Fill nail holes and cracks after first coat with non-shrinking putty of a color to match that of the finish.

I. Sand, dust and touch up scratches, abrasions or other disfigurements and remove foreign matter from prime coats before proceeding with the following coat. Featheredge spot priming or spot coating into adjacent coatings to produce a smooth and level surface.

J. Test concrete and plaster surfaces for moisture, using moisture meter, prior to painting. Do not apply paint to surfaces having meter reading above 15.

K. Caulk joints between door and window frames and walls, and other joints as necessary.

L. Coordinate the work of this section with the work of other trades.

3.03 APPLICATION:

A. Touch-up painting of structural steel, miscellaneous metal, hollow-metal doors and frames, and other materials which have been prime coated as may be required where the shop coat has been damaged by welding or abrasion during the handling and erection operations; also rivets, bolts and welds which are unpainted after assembly and erection.

B. Apply paint by spray in accordance with the manufacturer's directions to achieve required dry film thickness (DFT). Where specifically approved by the AR, use rollers or brushes as best suited for material being applied. For covers on rollers use carpet with velvet back and high-pile sheep's wool or use short-hair covers, as best suited for material and texture specified. Except where otherwise noted, apply paint to a minimum dry-film thickness (DFT) of five mils, excluding filler coats, using no less than the number of coats specified in Part 2 – Products.\

C. Apply material evenly and smoothly without runs, sags or other defects with edges of paint adjoining other materials or color sharp and clean, without overlapping.

D. Do not paint and finish while surfaces are damp. Allow sufficient time between coats, in accordance with manufacturer's directions to produce an evenly smooth finish.

E. Do not apply final coats until after other trades, whose operations would be detrimental to finish painting, have finished their work in the areas to be painted and the areas have been approved for painting.

F. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

G. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

H. Seal surfaces that might cause bleed through or staining of topcoat.

I. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

J. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

K. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

L. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

M. Concrete Floors and Traffic Surfaces to be Painted: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

N. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-PC 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).

O. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

P. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

3.04 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance.

D. Sand wood and metal surfaces lightly between coats to achieve required finish.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 FIELD QUALITY CONTROL

A. Quality Control Engineer to provide field inspection.

3.06 PROTECTION:

A. Dispose of soiled cleaning rags and waste at the close of each day's work or store such soiled rags and waste in metal containers with tight-fitting covers. Provide buckets of sand during painting operations for use in the event of fire. Post NO SMOKING signs as

necessary and as directed.

B. Protect the work of other trades against damage or injury by use of suitable covering during the progress of the painting and finishing work. Repair damage to the satisfaction of the AR.

3.07 CLEANING:

A. Upon completion of work, remove staging, scaffolding and containers from the site. Remove paint spots, oil or stains from glass, floors and other surfaces not to be painted, and leave job clean and acceptable to the AR.

END OF SECTION

SECTION 09910

TRAFFIC STRIPING AND PAINTING

PART 1 GENERAL

1.01 SUMMARY

A. Work Included: The work includes the furnishing of all labor materials, tools, equipment, and supervision necessary incidental to install traffic striping and other pavement markings as indicated in the Contract Drawings.

1.02 RELATED SECTIONS

A. Section 01550 – Access Roads, Parking Areas and Parking Controls

B. Section 01560 – Temporary Barriers and Closures

C. Section 07180 – Traffic Coatings

D. Section 07190 – Water Repellents

1.03 REFERENCE STANDARDS

A. ICRI Guideline No. 03732, “Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays”, January 1997 and latest edition.

B. ASTM D3359-95a, “Standard Test Methods for Measuring Adhesion by Tape Test”.

1.04 DEFINITIONS

A. Definitions of Painting Terms: ASTM D 16, unless otherwise specified.

B. Dry Film Thickness (DFT): Thickness of a coat of paint in fully cured state measured in mils (1/1000 inch).

1.05 SUBMITTALS

A. Product Data: Submit manufacturer’s product data for each coating, including generic description, complete technical data, surface preparation, and application instructions.

B. Color Samples: Submit manufacturer’s color samples showing full range of standard colors.

C. Contractor shall submit shop drawings for all levels of each parking garage, the striping layout, pavement marking layout, and description of equipment to be used for removing and installing the new striping and markings.

D. Manufacturer's Quality Assurance: Submit manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.

E. Warranty: Submit manufacturer's standard warranty.

1.06 QUALITY ASSURANCE

A. Field Samples:
   1. Provide a full coating system to the required sheen, color, texture, and recommended coverage rates. Simulate finished lighting conditions for reviewing in-place work.
   2. The AR or Quality Control Engineer will select two areas, or combinations of areas and surfaces and conditions for traffic striping. At least one (1} area shall be on Level 2 or 3 (representing the water repellant coating) and at least one (1) area shall be on Roof (representing the urethane traffic bearing coating). Apply traffic striping in these areas, combinations of areas and surfaces according to the schedule, or as specified. After finishes are accepted, these areas or combinations of areas and surfaces will serve as the standard of quality and for evaluation of traffic striping of similar nature.
   3. A manufacturer's representative shall be available upon request by the General Contractor or Painting subcontractor, to advise applicator on proper application technique and procedures.

B. Contractor Qualifications:
   1. Contractor shall be qualified to install vehicular striping and markings in accordance with Contract Drawings, with a successful track record of 5 years or more. Contractor shall maintain qualified personnel who have received product training by a manufacturer's representative.

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:

   1. Material name.
   2. Manufacturer.
   3. Color name and number.
   4. Batch or lot number.
   5. Date of manufacture.
   6. Mixing and thinning instructions.

B. Storage:
   1. Store materials in a clean dry area and within temperature range in accordance with manufacturer's instruction.
   2. Keep containers sealed until ready for use.
   3. Do not use materials beyond manufacturer's shelf life limits.

C. Handling: Protect materials during handling and application to prevent damage or contamination.

1.08 SEQUENCING

A. Job Conditions:
   1. Contractor shall perform all work while maintaining vehicular parking to site and within site that are not under construction in accordance with Section 01550 and Contract Drawings.
   2. Contractor shall provide adequate signalization in accordance with Section 01560 and Contract Drawings.

PART 2 PRODUCTS

2.01 MATERIALS

A. Contractor shall select traffic striping manufacturer whose product is compatible with the concrete water repellent coating (Specification Section 07190) and the traffic bearing urethane topping (Specification Section 07180). Colors shall comply with VDOT and MDOT Standards: White pavement marking material shall be equal to Federal Standard Color No. 595 – 17886 and yellow pavement marking material shall be equal to Federal Standard Color No. 595 – 13538. The following guidelines must be adhered to:
   1. Paint shall be Type A, solvent base traffic paint, conforming to the requirements of Section 704 of the VDOT Road and Bridge Specifications and Federal Specification TT-P-1952.
   2. Curb painting color along fire lanes and cross walks shall be yellow, unless otherwise indicated.

2.02 MATERIAL PREPARATION

A. Mix and thin materials according to manufacturer's latest printed instructions.

B. Do not use materials beyond manufacturer's recommended shelf life.

C. Do not use mixed materials beyond manufacturer's recommended pot life.

2.03 CURING

A. All concrete surface painting shall be applied after proper application and curing of the urethane traffic bearing coating specified in Section 07180 (at Roof) or the water repellant coating specified in Section 07190. A minimum of 48 hours shall be provided for the urethane traffic bearing coating and water repellant coating to cure prior striping and painting.

2.04 EQUIPMENT

A. Contractor shall provide:
   1. For removal of existing striping and markings:
   2. For installation of new striping and markings:
      a. Commercial compressed air spray striping machine capable of applying an even coating at the manufacturer's recommended thickness in an even width across the stripe.
      b. Or commercial airless spray striping machine capable of applying an even coating at the manufacturer's recommended thickness in an even width across the stripe.
   3. The equipment used for application of the paint shall be approved by the AR prior to start of work, and shall be capable of applying waterborne traffic paint that has been approved by the Authority.
   4. The Contractor shall provide access to the paint application equipment for inspection by the AR or the Quality Control Engineer.
   5. The footage counters used to measure pavement markings shall be calibrated, and a notarized, certification shall be submitted to the AR as part of the Quality Control Plan.
   6. The applicator shall provide a method for cleanly cutting off stripe ends and shall be capable of applying all longitudinal pavement markings.
   7. The equipment shall provide continuous uniform stripe dimensions of widths in accordance with the Contract Drawings and the AR.
   8. The equipment shall be mobile and maneuverable to the extent that straight lines can be followed and all standard curves can be made in true arcs.
   9. All parts of the equipment shall be thoroughly cleaned of foreign material or different colored material prior to the introduction of a new batch of material.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to be coated and report conditions that would be adversely affect the appearance or performance of coating systems, and which cannot be put into an acceptable condition by preparatory work specified.

B. Do not proceed with surface preparation and application until surface is acceptable.

3.02 SURFACE PREPARATION

A. General:
   1. Dislodge dirt, rust, mortar spatter and other dry material by scrapping or brushing. Remove dust and loose material by brushing, sweeping, vacuuming or blowing with high pressure air.
   2. Remove oil, wax and grease by scrapping off heavy deposits and cleaning with mineral spirits or a hot trisodium phosphate solution followed by a water rinse.

3. Verify that surfaces to be coated are dry, clean and free of dust, dirt, oil, wax, grease or other contaminants.
4. Allow coatings to cure and minimum of 48 hours.

3.03 ADHESION TESTING – CONCRETE SURFACES

A. At the first work area, a sample area will be prepared for traffic striping application. The concrete water repellant coating shall be applied in accordance with Specification Section 07190 Water Repellents at elevated levels. The urethane traffic bearing coating shall be applied in accordance with Specification Section 07180 Traffic Toppings. Traffic striping samples shall be installed and allowed to cure for a minimum period of seven (7) calendar days.

B. Adhesion testing shall be performed using the procedures of ASTM D3359-95a, Test Method A. Adhesion rating shall not be less than 4A. Two adhesion tests shall be performed at each level of the parking garage.

C. A representative of the Contractor and Coating manufacturer shall be present during the adhesion testing.

D. If acceptable adhesion ratings are not achieved in the sample, the Contractor shall prepare additional sample areas with the use of different spray tip and pressure combinations to better prepare the surface. Adhesion testing of the additional samples shall be performed and the least aggressive combination accepted that produces acceptable adhesion test results.

3.04 PAINT APPLICATION

A. After surface preparation, fill all bug holes, small spalls and surface imperfections with a surface patching compound. Allow to cure.

B. Apply coating by brush or roller. Apply coating to produce an even uniform appearance. Each coat shall be applied at the rate required by the manufacturer. Apply additional coats as required at repaired areas to blend with the surrounding surfaces.

C. Allow the manufacturer's minimum curing time between coats.

3.05 CLEANING AND TOUCH- UP

A. Remove coating splatters from glass and adjacent surfaces.

B. Repair and touch-up all work that is damaged, scratched or marred.

C. Remove all debris from the work area.

END OF SECTION

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SECTION 09970

SPECIAL COATINGS FOR STEEL

PART 1 GENERAL

1.01 SUMMARY

A. The work included: The work includes the furnishing of all labor materials, tools, equipment and supervision necessary to prepare, prime and paint interior steel.

1.02 RELATED SECTIONS

A. Section 05100 – Structural Metal Framing

B. Section 05500 – Metal Fabrications

1.03 REFERENCE STANDARDS

A. American Society of Testing Materials:
1. ASTM B117 – “Test Method for Salt Spray (fog) Testing”.
2. ASTM D16 – “Terminology Relating to Paint, Varnish, Lacquer, and Related Product”.
3. ASTM D149 – “Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies”.
4. ASTM D522 – “Test Methods for Mandrel Bend Test of Attached Organic Coatings”.
5. ASTM D870 – “Practice for Testing Water Resistance of Coatings Using Water Immersion”.
6. ASTM D1014 – “Practice for Conducting Exterior Exposure Tests of Paints on Steel”.
7. ASTM D1653 – “Test Methods for Water Vapor Transmission of Organic Coating Films”.
8. ASTM D2794 – “Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)”.
9. ASTM D3273- “Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber”.
10. ASTM D3359 – “Standard Test Methods for Measuring Adhesion by Tape Test”.
11. ASTM D3363 – “Test for Film Hardness by Pencil Test”.
12. ASTM D4060 – “Test Method for Abrasion of Organic Coatings by the Taber Abraser”.
13. ASTM D4141 – “Practice for Conducting Accelerated Outdoor Exposure Tests of Coatings”.
14. ASTM D4263 – “Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method”.
15. ASTM D4541 – “Test Method for Pull-Out Strength of Coatings Using Portable Adhesion – Testers”.

16. ASTM D4585 – “Practice for Testing the Water Resistance of Coatings Using Controlled Condensation”.
17. ASTM E84 – “Test Methods for Surface Burning Characteristics of Building Materials”.
18. ASTM G8 – “Test Methods for Cathodic Disbonding of Pipeline Coatings”.
19. ASTM G53 – “Practice for Operating Light-and-Water-Exposure Apparatus (Fluorescent UV-Condensation Type) For Exposure of Nonmetallic Materials”.

B. Steel Structures Painting Council:
1. SSPC – SP 1 – Solvent Cleaning.
2. SSPC – SP 2 – Hand Tool Cleaning.
3. SSPC – SP 3 - Power Tool Cleaning.
4. SSPC – SP 6/NACE 3 – Commercial Blast Cleaning.
5. SSPC – PA-1 – Painting Application Specification.

1.04 DEFINITIONS

A. Definitions of Painting Terms: ASTM D 16, unless otherwise specified.

B. Dry Film Thickness (OFT): Thickness of a coat of paint in fully cured state measured in mils (1/1000 inch).

1.05 SUBMITTALS

A. Product Data: Submit manufacturer’s product data for each coating, including generic description, complete technical data, surface preparation, and application instructions.

B. Color Samples: Submit manufacturer’s color samples showing full range of standard colors.

C. Manufacturer’s Quality Assurance: Submit manufacturer’s certification that coatings comply with specified requirements and are suitable for intended application.

D. Warranty: Submit manufacturer’s standard warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: The manufacturer shall provide evidence showing that specified materials have been manufactured and successfully installed with a minimum of ten (10) years of experience. The manufacturer shall be able to demonstrate successful performance on comparable projects. Coatings and coating application accessories shall be products of a single manufacturer.

B. Applicator’s Qualifications: Applicators will be a Licensed Applicator of the manufacturer of the specified product who has completed a formal program of instruction in the use of the specified metal coating system. Applicator shall have been a Licensed Applicator of the specified product for a minimum of three (3) years.

Applicator will provide certification attesting to their Licensed Applicator status at time of bid.

C. Pre-application Meeting: Convene a pre-application meeting two (2) weeks before start of application of coating systems. Require attendance of parties directly affecting work of this section, including Contractor, AR, applicator, and manufacturer's representative. Review the following:
   1. Environmental requirements.
   2. Protection of surfaces not scheduled to be coated.
   3. Surface preparation.
   4. Application.
   5. Repair.
   6. Field quality control.
   7. Cleaning.
   8. Protection of coating systems.
   9. Coordination with other work.

D. Field Samples:
   1. Provide a full coating system to the required sheen, color, texture, and recommended coverage rates. Simulate finished lighting conditions for reviewing in-place work.
   2. The AR or Quality Control Engineer will select one area, or combinations of areas and surfaces and conditions for each type of coating and substrate to be coated. Apply coatings in this area, combination of areas and surfaces according to the schedule, or as specified. After finishes are accepted, this area or combination of areas and surfaces will serve as the standard of quality and for evaluation of coating systems of similar nature.
   3. A manufacturer's representative shall be available upon request by the General Contractor or Painting subcontractor, to advise applicator on proper application technique and procedures.

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:
   1. Material name.
   2. Manufacturer.
   3. Color name and number.
   4. Batch or lot number.
   5. Date of manufacture.
   6. Mixing and thinning instruction.

B. Storage:
   1. Store materials in a clean dry area and within temperature arrange in accordance with manufacturer's instructions.
   2. Keep containers sealed until ready for use.
   3. Do not use materials beyond manufacturer's shelf life limits.

C. Handling: Protect materials during handling and application to prevent damage or contamination.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Weather:
   1. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
   2. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above dew point.
   3. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.
   4. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
   5. Wind: Do not spray coatings if wind velocity is above manufacturer's limit.
   6. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with manufacturer's instructions.

B. Dust and Contaminants:
   1. Schedule coating work to avoid excessive dust and airborne contaminants.
   2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

PART 2 PRODUCTS

2.01 MATERIALS

A. Primer Performance Requirement: Products require the following performance standards be met or exceed:
   1. Ferrous Metals
      a. Type: Aromatic Urethane Zinc-Rich
      b. Properties:
         1) Solids by Volume: Greater than 60%
         2) VOC:
            a) Unthined: 2.67 lbs./gallon (320 grams/litre)
            b) Thinned 2.5%: 2.78 lbs./gallon (333 grams/litre)
            c) Thinned 10%: 3.09 lbs./gallon (370 grams/litre)
      c. Curing Time: At 75 degrees F (24 degrees C) (curing time varies with surface temperature, air movement, humidity and film thickness.)
         1) To Handle: ¼ to 1 hour (use Urethane Accelerator for faster re-coat times).
         2) To Re-Coat: 2 to 5 hours (use Urethane Accelerator for faster re-coat times).
      d. Performance Criteria:
         1) Adhesion: ASTM D4541 (Elcometer): Not less than 800 psi (5.5 MPa) pull.

2) Adhesion, ASTM 03359, (Method B, 5 mm Crosshatch): No less than a rating of 5.
3) Exterior Exposure; Saltwater, splash and spray (Atlantic seacoast): No blistering, cracking, rusting or delamination of film after one year exposure.
4) Humidity; ASTM 04585: No blistering, cracking, rusting or delamination of film after 1,000 hours exposure.
5) Salt Spray (Fog); ASTM 8117: No blistering, cracking, rusting or delamination of film. No more than 1/64" (0.4 mm) rust creepage at scribe after 10,000 hours exposure.
6) Static Fatigue (Slip Coefficient & Tension Creep): Method: Perform tests in compliance with AISC specifications using equipment as described in Research Council on Structural Connections Specifications Appendix A, Section 4.1 Results: Class B surface with a mean slip coefficient not less than 0.50 and a tension creep not in excess of .005" (0.13 mm).

2. Galvanized Steel
   a. Type: Polyamide Epoxy
   b. Properties:
      1) Solids by Volume: Greater than 55%
      2) VOC:
         a) Unthinned: 2.88 to 3.18 lbs./gallon (345 to 381 grams/litre).
         b) Thinned 5%: 3.07 to 3.36 lbs./gallon (367 to 402 grams/litre).
         c) Thinned 10%: 3.25 to 3.52 lbs./gallon (389 to 421 grams/litre).
   c. Curing Time: At 75 degrees F (24 degrees C) (Curing time varies with surface temperature, air movement, humidity and film thickness.)
      1) To Touch: 1 hour,
      2) To Handle: 2 to 3 hours.
      3) To Re-Coat: 3 to 4 hours.
   d. Performance Criteria:
      1) Abrasion: ASTM D4060, (CS-17 Wheel, 1,000 grams load): No more than 115 mg. loss after 1,000 cycles.
      2) Adhesion: ASTM D3359, (Method B, 5 mm Crosshatch): No less than a rating of 5; average of three tests.
      3) Adhesion: ASTM D4541 (Elcometer): No less than 1,000 psi (6.89 MPa) pull; average of five tests.
      4) Exterior Exposure: exposed at 45 degrees facing south (light industrial area): No blistering, cracking or delamination of film. No rust creepage at scribe or no rusting at edges after 72 months of exposure.
      5) Fresh Water: Continuous immersion in tap water at 75 degrees F (24 degrees C): No blistering, cracking, rusting or delamination of film after four years.
      6) Hardness; ASTM 03363 (Pencil): Pass 3H (Gouge).
      7) Humidity; ASTM 04585: No blistering, cracking, rusting or delamination of film after 4,500 hours exposure.
      8) Salt Spray (Fog); ASTM B117: No blistering, cracking, rusting, or delamination of film. No more than 1/32" (0.8 mm) rust creepage at scribe after 1,500 hours exposure.

9) Surface Burning Characteristics; ASTM E84: Class A.

B. Intermediate Coat Performance Requirements: Products require the following performance standards be met or exceeded:
   1. Ferrous Metals
      a. Type: Polyamide Epoxy
      b. Properties:
         1) vi. Solids by Volume: Greater than 55%
         2) vii. VOC:
            a) Unthinned: 2.88 to 3.18 lbs./gallon (345 to 381 grams/litre)
            b) Thinned 5%: 3.07 to 3.36 lbs./gallon (367 to 402 grams/litre)
            c) Thinned 10%: 3.25 to 3.52 lbs./gallon (389 to 421 grams/litre)
      c. Curing Time: At 75 degrees F (24 degrees C) (curing time varies with surface temperature, air movement, humidity and film thickness.)
         1) To Touch: 1 hour
         1) To Handle: 2 to 3 hours
         2) To Re-coat: 3 to 4 hours
      d. Performance Criteria:
      e. Abrasion: ASTM D4060, (CS-17 Wheel, 1,000 grams load): No more than 115 mg. loss after 1,000 cycles.
      f. Adhesion: ASTM D3359, (Method B, 5 mm Crosshatch): No less than a rating of 5; average of three tests.
      g. Adhesion: ASTM D4541 (Elcometer): No less than 1,000 psi (6.89 MPa) pull; average of five tests.
      h. Exterior Exposure: exposed at 45 degrees facing south (light industrial area): No blistering, cracking or delamination film. No rust creepage at scribe or no rusting at edges after 72 months exposure.
      i. Fresh Water: Continuous immersion in tap water at 75 degrees F (24 degrees C: No blistering, cracking, rusting or delamination of film after four years.
      j. Hardness: ASTM D3363 (Pencil): Pass 3H (Gouge).
      k. Humidity: ASTM D4585: No blistering, cracking, rusting or delamination of film after 4,500 hours exposure.
      l. Salt Spray (Fog): ASTM B117: No blistering, cracking, rusting or delamination of film. No more than 1/32” (0.8 mm) rust creepage at scribe after 1,500 hours exposure.
      m. Surface Burning Characteristics: ASTM E84: Class A.

C. Finish Coat Performance Requirements: Products require the following performance standards be met or exceeded.
   1. Type: Aliphatic Acrylic Polyurethane.
   2. Finishes: gloss, semi-gloss, or satin.
   3. Properties:
      a. Solids by Volume: Greater than 70%.
      b. VOC:
         1) (Unthinned): 1.81 lbs./gallon (420 grams/litre).

2) No. 39 Thinner (Maximum 20%): 2.55 lbs./gallon (305 grams/litre).
3) No 42 Thinner (Maximum 20%): 2.63 lbs./gallon (315 grams/litre).
4) Curing Time: At 75 degrees F (24 degrees C) (curing time varies with surface temperature, air movement, humidity and film thickness).

a. To Touch: 1 hour
b. To Handle: 2-1/2 to 6 hours
c. To Re-coat: 5 to 6 hours

4. Performance Criteria: Unless otherwise indicated, coating systems for tests were applied to SSPC SP10 cleaned steel and cured at 75 degrees F (24 degrees C).
   a. Abrasion; ASTM 04060, (CS-17 Wheel, 1,000 grams load): No more than 75 mg loss after 1,000 cycles.
   b. Adhesion; ASTM 03359, (Method B. 5 mm Crosshatch): No less than a rating of 5.
   c. Adhesion: ASTM D4541 (Elcometer): No less than 825 psi (5.86 MPa) pull; average of three tests.
   d. Exterior Exposure: exposed at 45 degrees facing south (South Florida marine exposure): No blistering, cracking or chalking of film; less than 40% gloss loss and less than 4.0 MacAdam units color change after two years exposure.
   e. Flexibility: ASTM D522 (Method B Cylindrical Mandrel): Passes 1/8” (3.2 mm) mandrel with elongation greater than 36.4% when cured for either seven or 30 days at 75 degrees F (24 degrees C).
   f. Graffiti Resistance: Complete and easy removal. Graffiti material as follows shall be applied to coating and allowed to dry for seven days; acrylic, epoxy-ester and alkyd spray paints, crayon, lipstick, shoe polish, ball point ink and markette marker. Removal first attempted with xylene, if graffiti remained then menthyl ethyl ketone (MEK) used: if graffiti remained Spray Pak Vandal Mark Remover used.
   g. Hardness; ASTM D3363: No gouging with an HB or less pencil.
   h. Humidity: ASTM D4585: No blistering, cracking or delamination after 150 inch/pounds or less indirect impact.
   i. QUV Exposure: ASTM G53 (FS-40 bulbs, 4 hour light, 4 hours dark): No blistering, cracking or chalking; less than 55% gloss loss and less than 1.6 MacAdam units color change after 1 ,000 hours exposure.
   j. Salt Spray (Fog); ASTM 8117: No blistering, cracking, rusting or delamination of film. No more than 1/32" (.8 mm) rust creepage at scribe after 1,000 hours exposure.

2.02 COATING SYSTEMS FOR EXTERIOR STEEL

A. Exterior Exposed Ferrous Metals:
   1. System: Epoxy/urethane.
   2. Surface Preparation: SSPC-SP6/NACE 3 or as specified by manufacturer.
   3. Shop or Field Primer: DFT 2.5 to 3.5 mils, or as specified by manufacturer.
   4. Field Intermediate Coat: DFT 2.0 to 3.0 mils, or as specified by manufacturer.
   5. Field Finish Coat: DFT 2.0 to 5.0 mils, or as specified by manufacturer.
   6. Total DFT: 6.5 to 11.5 mils, or as specified by manufacturer.

7. Finish Color: As selected by AR from manufacturer's standard colors.

B. Galvanized Steel with Mild to Moderate Atmospheric or UV Exposure:
   1. System Type: Epoxy/urethane.
   2. Surface Preparation: Abrasive blast and/or chemically clean. Consult manufacturer for requirements.
   3. Shop or Field Primer: DFT 2 to 3 mils, or as specified by manufacturer.
   4. Field Finish Coat: DFT 2 to 3 mils, or as specified by manufacturer.
   5. Total DFT: 4 to 6 mils, or as specified by manufacturer.
   6. Finish Color: As selected by AR from manufacturer's standard colors.

2.03 ACCESSORIES

A. Coating Application Accessories:
   1. Accessories require for application of specified coatings in accordance with manufacturer’s instructions, including thinners.
   2. Products of coating manufacturer.

2.04 MATERIAL PREPARATION

A. Mix and thin materials according to manufacturer’s latest printed instructions.

B. Do not use materials beyond manufacturer’s recommended shelf life.

C. Do not use mixed materials beyond manufacturer’s recommended pot life.

2.05 PAINTING SCHEDULE

A. Structural Steel: All galvanized steel saddles used at concrete double tee corbels.

B. Steel Rails: All new and existing handrails and guardrails indicated in the Contract Drawings.

C. Miscellaneous Steel: All steel pipes, storm drain risers, stand pipes, drain brackets and pipe assemblies, fire lines, bollards, utility guards, and other steel indicated in the Contract Drawings.

D. Colors:
   1. Prior to beginning work, the Contractor will be furnished sample color chips and a Color and Material Schedule for surfaces to be painted.
   2. Match the colors of the chips and submit samples before proceeding. Label samples for surface finishes such as satin, flat or gloss as listed in the Color and Material Schedule.
   3. Tint each coat of paint slightly lighter or darker than the preceding coat or the finish coat.
   4. Final approval of colors will be made by the AR on samples applied on the Job.
   5. Safety Colors Items specified to be safety colors, e.g. OSHA red (safety red) and ANSI orange, to be in compliance with ANSI Z535 1, Safety Color Code

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to be coated and report conditions that would adversely affect the appearance or performance of coating systems, and which cannot be put into an acceptable condition by preparatory work specified. Notify Quality Control Engineer of areas or conditions which are not acceptable.

B. Do not proceed with surface preparation and application until surface is acceptable.

C. Coordinate surfaces to be painted with Section 05100 and Section 05500.

3.02 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.

B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.03 SURFACE PREPARATION OF STEEL

A. Prepare steel surfaces in accordance with manufacturer's instructions. Dislodge dirt, rust, mortar spatter and other dry material by scrapping or brushing. Remove dust and loose material by brushing, sweeping, vacuuming or blowing with high-pressure air.

B. Fabrication Defects:
   1. Correct steel and fabrication defects revealed by surface preparation.
   2. Remove weld spatter and slag.
   3. Round sharp edges and corners of welds to a smooth contour.
   4. Smooth weld undercuts and recesses.
   5. Grind down porous welds to pinhole-free metal.
   6. Remove weld flux from surface.

C. Ensure surfaces are dry.

D. Steel Surfaces: Remove visible oil, grease, dirt, dust paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 6/NACE 3.

E. Totally Spray-Applied Shop Coating Systems for Steel: Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 6/NACE 3.

F. Abrasive Blast-Cleaned Surfaces: Coat abrasive blast-cleaned surfaces with primer before visible rust forms on surface. Do not leave blast-cleaned surfaces uncoated for more than 8 hours.

G. Shop Primer: Prepare shop or field primer to receive field coat in accordance with manufacturer's instructions.

3.04 SURFACE PREPARATION OF GALVANIZED STEEL AND NONFERROUS METAL

A. Prepare galvanized steel and nonferrous metal surfaces in accordance with manufacturer's instructions. Surface preparation recommendations will vary depending on substrate and exposure conditions.

3.05 APPLICATION

A. Steel:

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1. All rails and posts shall be shop primed and coated with air spray equipment in accordance with the manufacturer's application recommendations.
2. All painted steel shall be wrapped and protected during transportation and while stored on site.
3. Follow the manufacturer's product data sheets for mixing, application and curing.
4. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.
5. The surface shall be dry and at least 5°F above the dew point temperature prior to primer, intermediate or finish coat application. Minimum application temperature: 35°F. Maximum application temperature: 135°F. Apply and cure coatings in accordance with manufacturer's recommendations.
6. Keep containers closed when not in use to avoid contamination.
7. Do not use mixed coatings beyond pot life limits.
8. Use application equipment, tools, pressure setting, and techniques in accordance with the manufacturer’s instructions.
9. Uniformly apply coatings at spreading rate required to achieve specified DFT.
10. Apply coatings to be fee of film characteristics or defects that would adversely affect performance or appearance of coating systems.
11. Stripe paint with brush critical locations on steel such as welds, corners, and edges using specified primer.

3.06 REPAIR

A. Inspector’s Services:
   1. Verify coatings and other materials are as specified.
   2. Verify surface preparation and application are as specified.
   3. Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gauges.
   4. Coating Defects: Check coatings for film characteristics or defects that would adversely affect performance or appearance of coatings systems. Check for holidays on interior steel immersion surfaces using holiday detector.
   5. Report:
      a. Submit written reports describing inspections made and actions taken to correct nonconforming work.

b. Report nonconforming work not corrected.
c. Submit copies of report to Architect and Contractor.

B. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

3.07 CLEANING

A. Remove temporary coverings and protection of surrounding areas and surfaces.

B. Remove coating splatters from glass and adjacent surfaces.

C. Repair and touch-up all work that is damaged, scratched or marred.

D. Remove all debris from the work area.

END OF SECTION

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SECTION 16050

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Requirements for basic electrical studies and reports, material handling, and other basic electrical materials and methods.

B. Related Sections:
   1. Refer to Procurement Documents
   2. Section 16060 Grounding and Bonding for Electrical Systems
   3. Section 16070 Hangers and Supports for Electrical Systems
   4. Section 16120 Low Voltage Electrical Power Conductors and Cables
   5. Section 16130 Conduit for Electrical Systems
   6. Section 16131 Wireways for Electrical Systems
   7. Section 16132 Boxes for Electrical Systems
   8. Section 16075 Identification for Electrical Systems
   9. Section 16080 Acceptance of Electrical Systems
   10. Section 16145 Wiring Devices

1.02 REFERENCES

A. Regulatory Agency Sustainability Approvals:
   1. Buy America Act:
      a. Except for those products which are exempt under the specific statutory waivers stipulated in 49 CFR 661, all other products supplied under this Section must comply with the requirements of the Buy America Act.

B. National Fire Protection Association (NFPA):
   1. NFPA 70, National Electrical Code (NEC).
   2. NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces.

1.03 SUBMITTALS

A. Submit the following information for approval in accordance with the requirements of the Procurement Documents:
   1. Product Data:
      a. Submit Product Data, including catalog cuts, for all products provided for the electrical work of this Contract and as specified in other Sections.
         1) Clearly indicate the usage of each product on each submittal.

1.04 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Buy America Act:
      a. Except for those products which are exempt under the specific statutory waivers stipulated in 49 CFR 661, all other products supplied under this Section must comply with the requirements of the Buy America Act.

B. Regulatory Requirements:
   1. Perform all electrical work in conformance with the requirements of NFPA 70, the National Electrical Code.

C. Certifications:
   1. Submit evidence with all Product Data that the products represented meet testing agency quality verification requirements, including agency listing and labeling requirements.
      a. Such evidence may consist of either a printed mark on the data or a separate listing card.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and equipment to the work site in accordance with the requirements of the Procurement Documents.
   1. Deliver materials and equipment in a clean condition.
      a. Provide packaging that plugs, caps, or otherwise seals openings both during shipping and temporary storage.
   2. Provide equipment needed for unloading operations, and have such equipment on the work site to perform unloading work when the material and equipment is delivered.
      a. If possible, clearly identify pick-points or lift-points on electrical equipment crating and packaging.
      b. In the absence pick-points or lift-points on equipment crating and packaging, identify pick-points or lift-points on the equipment itself.

B. Handle materials and equipment in accordance with the requirements of The Procurement Documents.
   1. Handle materials and equipment in accordance with manufacturer's written instructions.
   2. When unloading materials and equipment, provide special lifting harnesses or apparatus as required by manufacturers.

C. Store electrical materials and equipment, whether on-site or off-site, in accordance with The Procurement Documents and the following:

1. Follow the manufacturer's written instructions for storing the items.
2. Store electrical equipment and products under cover.
    a. Except for electrical conduit, store electrical equipment and products in heated warehouses or enclosed buildings with auxiliary heat and that provide protection from the weather on all sides.

PART 2 PRODUCTS

2.01 MATERIALS

A. Grounding and Bonding Materials:
    1. Provide grounding and bonding materials in accordance with the requirements of Section 16060.

B. Hangers and Supports:
    1. Provide hangers and supports for electrical equipment in accordance with the requirements of Section 16070.

C. Electrical Identification Materials:
    1. Provide electrical identification materials in accordance with the requirements of Section 16075.

D. Wire and Cable:
    1. Provide low-voltage electrical wire, cable, and accessories in accordance with the requirements of Section 16120.

E. Conduit and Raceway:
    1. Provide conduit and raceway as indicated, as appropriate for the application per NFPA 70, and in accordance with the following:
        a. Conduit and Tubing: Provide electrical conduit and tubing in accordance with the requirements of Section 16130.
        b. Wireway and Fittings: Provide electrical wireway and fittings in accordance with the requirements of Section 16131.

F. Wiring Devices:
    1. Provide electrical wiring devices in accordance with the requirements of Section 16145.

2.02 SHOP FINISHING

A. For electrical equipment, factory-apply paint and coating systems that at a minimum meet the requirements of the NEMA ICS 6 corrosion-resistance test and the additional requirements specified in individual Specifications.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. The quality of finishing and refinishing work is subject to approval by the Authority.

END OF SECTION

SECTION 16060

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Requirements for connecting, energizing, testing, cleaning, and protecting grounding and bonding systems.

B. Related Sections:
   1. Refer to Procurement Documents
   2. Section 16050 Common Work Results for Electrical
   3. Section 16080 Acceptance of Electrical Systems
   4. Section 16130 Conduits for Electrical Systems

1.02 REFERENCES

A. Reference Standards:
   1. U. S. Government:
      a. Federal Transit Administration (FTA):
   2. 49 CFR 661 Buy America Requirements

B. American Society for Testing Materials (ASTM):
   1. ASTM B 1; Standard Specification for Hard-Drawn Copper Wire.
   2. ASTM B 8; Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

C. National Fire Protection Association (NFPA):
   1. NFPA 70, National Electrical Code (NEC).

D. National Electrical Manufacturing Association (NEMA):
   1. NEMA WC-7; Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

E. Underwriter's Laboratories, Inc. (UL):
   1. UL 467, Standard for Grounding and Bonding Equipment.
   2. UL 486A-486B, Wire Connectors.
   3. UL 486C, Standard for Splicing Wire Connections.
   4. UL 486D, Standard for Insulated Wire Connector Systems for Underground Use or in Damp or Wet *Locations.*
   5. UL 486E, Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.

1.03 DESIGN REQUIREMENTS

A. Design the electrical system installation to conform to Article 300 of NFPA 70, Wiring Methods, and to other applicable articles of NFPA 70 governing methods of wiring.

B. Ground the conduit systems, metal enclosures and receptacles in accordance with Article 250 of NFPA 70, Grounding.
   1. Ground all metallic conduits, wiring channels, junction boxes, or pull boxes.
      a. Bond each run of raceways to form a continuous path for ground faults from end to end.
      b. When liquid tight flexible metal conduit is installed, provide external bond wires.
   2. Provide insulated, Type XHHW-2 internal equipment ground wire in all conduits.
      a. Bond the internal wire to all pullboxes, junction boxes, equipment enclosures, and other enclosures as required by NFPA 70.

C. Equipment Grounds:
   1. All feeders and branch circuits to include an equipment grounding conductor consisting of a copper wire within a raceway or cable and sized as specified herein.
      a. Where conductors are run in parallel in multiple raceways, run the equipment grounding conductor in parallel to the related conductors.
      b. Size each of the parallel equipment grounding conductors on the basis of the ampere rating of the circuit overcurrent protecting device.

D. Ground Wire Sizes:
   1. When the ground wire size is not specified or indicated on the Contract Drawings, provide wire sized in accordance with the requirements of NFPA 70.

E. Within 60 days of the Contract award, submit the following:
   1. The Submittals required by Section 16050.
      a. Include Product Data and Catalog Cuts for all products provided, and describe the usage of each product.

1.04 SUBMITTALS

A. Submit the following information for approval in accordance with the requirements of the Procurement Document:
   1. Product Data:
      a. Manufacturer’s product data

1.05 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Buy America Act:

a. Except for those products which are exempt under the specific statutory waivers stipulated in 49 CFR 661, all other products supplied under this Section must comply with the requirements of the Buy America Act.

B. Qualifications:
1. Installer Qualifications:
a. Employ installers who specialize in the work of this Section, and who can demonstrate a minimum of three years documented experience.
b. Submit the system installers' qualifications.
2. Supervisor's Qualifications:
a. Employ supervisor to supervise the installation work who are skilled licensed electricians.
b. Submit the installation supervisors' resumes.
3. All products are to be certified by Underwriters Laboratories, Inc. (UL),

C. Regulatory Requirements:
1. All grounding and bonding Work must comply with the requirements of NFPA 70, the National Electrical Code.

D. Certifications:
1. Testing Agency Product Certification:
a. Verify product quality by certifying products as meeting the requirements of one of the following:
1) Underwriters Laboratories, Inc. (UL).
a) Provide products listed and labeled by UL.
b. Testing agency product certification must include agency listing and labeling, either by a printed mark on the data or by a separate listing card.

1.06 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
1. Transport materials, both on site and from Contractor's storage to site, in accordance with the recommendations of the respective manufacturers.

B. Storage and Protection:
1. Store materials, both on and off site, in accordance with manufacturer's written instructions.
2. Store products indoors on blocking or pallets.

PART 2 PRODUCTS

2.01 MATERIALS

A. Wire:
1. Bare Ground Wire:

a. Soft drawn copper, Class A or Class B stranded, meeting the requirements of ASTM B8 for sizes #6 or larger.
b. Soft drawn solid copper, meeting the requirements of ASTM B1 for sizes #8 or smaller.

2. Insulated Ground Wire:
   a. Provide type XHHW-2 insulated Class B copper stranded wire rated for 600 volts that conforms to the requirements of NEMA WC-7, and is green in color.
3. Acceptable Manufacturers:
   a. Cablec Continental Co. www.continentalcablellc.com
   b. SouthWire www.southwire.com
   c. Okonite www.okonite.com
   d. Rome Cable
   e. Or Approved Equal

B. Clamps and Non-Welded Connectors:
1. Provide bronze or brass clamps and connectors that are UL listed for use below grade.
   a. All bolts and other material must be bronze or brass, plated steel screws are unacceptable.
   b. Fabricate multi-bolt, solderless compression clamps from high strength electrical bronze, and provide silicon bronze clamping bolts and hardware.
2. Provide bolts, nuts, lock-washers, and similar hardware designed not to damage ground wire.
3. Acceptable manufacturers:
   a. Ilsco.
   b. Framatone Connectors Inc. (FCI), Burndy.
   c. Or Approved Equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Site Verification of Conditions:
1. The Contract Drawings are generally indicative of the Work, but due to their small scale, it is not possible to indicate some offsets and fittings required nor the minor structural obstructions that may be encountered.
   a. Perform field measurements to discover offsets and fitting requirements not shown.
   b. Locate all on-site utilities and other obstructions in the area of construction, and verify that interferences will not occur.

3.02 PREPARATION

A. Layout electrical work to suit actual field conditions and in accordance with accepted standard practice.

3.03 INSTALLATION

A. Construct each ground system and connection so it is mechanically secure and electrically continuous.
   1. Secure grounds to boxes in such a manner that each system is electrically continuous from the point of service to each outlet.
   2. Terminate conduits using double locknuts and bushings.
      a. Unless a conduit run enters a metallic enclosure via integral threaded hubs, provide the conduit run with two locknuts.
   3. Clean paint, grease and such other insulating materials from the contact points of grounds.

B. Equipment Grounds:
   1. Grounding Lighting Fixtures:
      a. Provide the housing of each lighting fixture with a separate, factory-installed grounding device and ground conductor.
      b. Use the factory-installed grounding device for connecting a separate grounding conductor meeting applicable grounding requirements of the NEC to the fixture.
         1) Provide a green covered grounding conductor of the same wire gauge as the two power feed wires.
         2) Provide a continuous ground for the fixture construction.

3.04 FIELD QUALITY CONTROL

A. Site Testing:
   1. Perform a continuity test from all utilization and distribution equipment to the ground grid on a run-by-run basis.

B. Inspection:
   1. Prior to completion of the Work of this Section, inspect the items provided for conformity to the Contract Drawings and Specifications.

3.05 PROTECTION

A. Protect finished insulated wires from being painted.

END OF SECTION

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SECTION 16070

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Requirements for furnishing, installing, cleaning, and protecting hanger and support systems for electrical wiring, conduit boxes, and equipment.

B. Related Section:
   1. Refer to Procurement Documents
   2. Section 16050 Common Work Results for Electrical

1.02 REFERENCES

A. Reference Standards:
   1. U. S. Government:
      a. Federal Transit Administration (FTA):
   2. 49 CFR 661 Buy America Requirements

B. American Iron and Steel Institute (AISI):
   1. AISI Standard Steels (Handbook).

C. American Society for Testing Materials (ASTM):
   1. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi, Minimum Tensile Strength.
   2. ASTM A 563 - Standard Specification for Carbon and Alloy Steel Nuts.

D. American Welding Society (AWS):
   1. AWS D1.1/D1.1M - Structural Welding Code - Steel.

E. National Electrical Manufacturers Association (NEMA):
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts maximum).

F. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC).

G. Society of Automotive Authority's International (SAE):
   1. SAE J 429 - Mechanical and Material Requirements for Externally Threaded Fasterners.

H. U. S. General Services Administration (GSA)

1. Federal Specifications:
    a. A-A-1922A - Shield, Expansion (Caulking Anchors, Single Lead).
    b. FF-S-107C(2) - Screws, Tapping and Drive.

1.03 SUBMITTALS

A. Submit the following information to the Authority for approval in accordance with the requirements of the Procurement Documents, and Section 16050, Common Work Results for Electrical:
    1. Product Data:
        a. Provide product data and catalog cuts for the products provided under this Section.
    2. Quality Assurance/Control Submittals:
        1) Detailed drawings of proposed departures from the original design.
        b. Certificates:
            1) Testing Agency/Quality Verification:
                a) With the product data for electrical hangers and supports, provide evidence of quality verification, listing, and labeling by the Electrical Testing Agency (ETA); either by a printed mark on the data, or by a separate listing card.
            2) Manufacturers' Certificate of Compliance.
        c. Qualification Statements:
            1) Manufacturers' qualifications.

1.04 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
    1. Buy America Act:
        a. Except for those products which are exempt under the specific statutory waivers stipulated in 49 CFR 661, all other products supplied under this Section must comply with the requirements of the Buy America Act.

B. Qualifications;
    1. Electrical Testing Agency (ETA) Qualifications:
        a. Use the Electrical Testing Agency (ETA) qualified as specified in Section 16050, Common Work Results for Electrical.
    2. Manufacturers' Qualifications:
        a. Provide electrical support framing made by manufacturers that have been manufacturing support framing for a minimum of 5 years, and who carefully controls their operations to ensure that excellent product Authorizing, quality, safety, and reliability are achieved.
        b. Submit the manufacturer's qualifications to the Authority for approval.

C. Certifications:

1. Electrical Testing Laboratory (ETL) Certification:
   a. Provide products that are listed and labeled by Underwriters Laboratory, Inc. (UL) or certified as meeting the standards of UL by the Electrical Testing Laboratory (ETL) unless products meeting the requirements of these testing laboratories are not readily available or unless standards do not exist for the products.
2. Manufacturers Certificate of Compliance:
   a. Submit a manufacturer's Certificate of Compliance certifying that both the galvanizing and the products meet the requirements of the ASTM standards.

1.05 DELIVERY, STORAGE AND HANDLING

A. Packaging, Shipping, Handling, and Unloading:
   1. Deliver, store, and handle the hangers and supports in accordance with Section 16050, Common Work Results for Electrical, and as specified herein.
   2. Deliver material to Site in the original factory packaging.

B. Storage and Protection:
   1. Shelter and store the components under cover, and supported off the ground and floors on blocking.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

A. Metal U-Channel Electrical Support Framing Systems and Fittings:
   1. Carbon Steel U-Channel Support Framing Systems:
      a. Provide 1-5/8-inch nominal size U-channel supports fabricated from 12 gauge Type 316 stainless steel.
      b. Where combination members are required, spot-weld the members on 3-inch centers.
      c. Provide 1-5/8-inch or larger depths, except where supports are mounted directly to walls 13/16-inch or larger depths may be provided.
      d. Provide metal framing systems and fittings for metal framing systems from a single manufacturer.
      e. Manufacturers:
         1) Unistrut Corporation, Unistrut® Metal Framing System, www.unistrut.com.
         2) Thomas & Betts, Kindorf®, http://elec-cat.tnb.com.
         3) Cooper B-Line®, Inc., www.b-line.com.
         4) Or Approved Equal
   2. Stainless Steel U-Channel Support Framing Systems:
      a. Provide U-channel supports, fittings, threaded rod, and hardware fabricated from Type 316 stainless steel.

B. Conduit Supports:
   1. Malleable Iron Conduit Supports:
      a. Provide one-hole style galvanized malleable iron fasteners with pipe straps similar to those as manufactured by Thomas & Betts.
      b. Provide support devices consisting of threaded rods, channel supports, and conduit straps/fasteners.
   2. Manufacturers:
      a. Thomas & Betts, http://www-public.tnb.com/contractor/docs/superstrut.pdf.
      b. Or Approved Equal.

C. Bolts, Nuts, and Washers:
   1. For all bolts, nuts, and washers, provide 316 stainless steel fasteners complying with the requirements of ASTM A 325.

D. Anchors and Fasteners:
   1. Drive (Deep-Pitch) Screws:
      a. Provide Type 316 stainless steel self-tapping type drive (deep-pitch) screws that comply with the requirements of FF-S-107C(2).
   2. Drilled-In Anchors and Fasteners:
      a. Provide drilled-in anchors and fasteners that comply with the requirements of FF-S-107C(2).
      b. Masonry Anchors:
         1) Provide masonry anchors designed to accept both machine bolts and threaded rods as fasteners.
            a) Provide SAE J 429 Grade 2 machine bolt fasteners fabricated from AISI Type 316 stainless steel.
            b) Provide nuts and washers conforming to the requirements of ASTM A 563.
         2) Provide masonry anchors consisting of an expansion shield and expander nut contained inside the shield.
            a) Expander Nuts:
               (1) Fabricate square expander nuts with their sides tapered inward from the bottom to the top.
               (2) Design the expander nuts to simultaneously climb the bolt or rod thread and expand the shield as soon as the threaded expander nut reaches and bears against the shield bottom when being tightened.
            b) Expansion Shields:
               (1) Provide expansion shield bodies consisting of four legs, the inside of each tapered toward the shield bottom, or nut end.
               (2) The end of one leg shall be elongated and turned across shield bottom. Outer surface of shield body shall be ribbed for grip-action.

3) Masonry Anchor Material:
   a) Provide die cast Zamac No. 3 zinc alloy having a 43,000 psi minimum tensile strength.
4) Manufacturers:
   a) U.S.E. Diamond, Inc., FORWAY System, www.mktfastening.com.
   b) Or Approved Equal

c. Concrete Anchors:
1) Stainless Steel Anchor/Fastener:
   a) Provide one-piece AISI Type 303 or 304 stainless steel studs (bolts) with integral expansion wedges, AISI Type 316 stainless steel nuts, and AISI Type 316 stainless steel washers.
   b) Provide stainless steel anchor/fasteners complying with the physical requirements of FF-S-325 for Group II, Type 4, Class 1.
2) Acceptable Manufacturers:
   a) U.S.E. Diamond, Inc.; SUP-R-STUD, www.mktfastening.com.
   b) Hilti Fastening Systems; KWIK-BOLT, hilti.com.
   c) Molly Fastener Group; PARABOLT.
   d) Phillips; RED HEAD Wedge-Anchor, www.phillipsfastener.com.
   e) Or Approved Equal

3. Hammer drive-type explosive charge drive-type anchors and fastener systems are unacceptable.
4. Lead shields, plastic-inserts, fiber-inserts, and drilled-in plastic sleeve/nail drive systems are unacceptable.

2.02 ACCESSORIES

A. NOT USED

2.03 FABRICATION

A. Fit and shop assemble items in the largest sections practical for delivery to the Site.

PART 3 EXECUTION

3.01 EXAMINATION

A. Field Measurement:
1. Although the Contract Drawings are generally indicative of the Work, take field measurements to verify actual conditions.
   a. Due to the small scale of the Contract Drawings it is not possible to indicate all offsets, fittings, and apparatus required or the minor structural obstructions that may be encountered during the Work.
2. Carefully investigate the structural and finish conditions, and other construction work, at the Site which may affect the work of this Section.

3.02 PREPARATION

A. After carefully investigating structural and finish conditions and other in-place construction work, produce detailed Shop Drawings showing proposed departures from the original design due to field conditions or other causes.
   1. Layout the electrical work according to accepted standard electrical trade practice to suit actual field measurements.
   2. Arrange the electrical work to consider existing conditions and to preserve access to other equipment, rooms, areas, and similar features of the construction.

B. Obtain roughing-in dimensions of electrically operated equipment, including equipment being installed by both electrical and other construction trades.
   1. Set conduit and boxes only after receiving approved dimensions and checking such equipment locations.
   2. Arrange electrical Work accordingly and furnish such fittings and apparatus as required to accommodate such conditions and to preserve access to other equipment, rooms, areas, and similar spaces.

3.03 INSTALLATION

A. Install electrical Work in conformance to the requirements of NFPA 70 for wiring methods general requirements (Refer to Procurement Documents), and to other applicable Articles of the NEC governing methods of wiring.

B. Installing Anchors and Fasteners:
   1. For anchoring or fastening applications in masonry and hollow-core precast concrete structural elements, provide masonry anchors as specified herein.
   2. For anchoring or fastening applications in cast-in-place concrete and solid precast concrete structural elements, provide concrete anchors as specified herein.
   3. Threaded Bolts:
      a. Draw threaded bolted connections up tight using 316 stainless steel lock washers to prevent the bolt or nut from loosening.
   4. Drilled-In Expansion Anchors:
      a. Install expansion anchors in strict accordance with manufacturer's instructions and the following.
         1) Drill holes to the required diameter and depth in accordance with anchor manufacturer's instructions for the size of anchor being installed.
         2) Minimum Embedment:
            a) Embed expansion anchors to four and one-half bolt diameters minimum unless otherwise indicated on the Contract Drawings.

C. Installation of U-Channel Support Framing Systems in accordance with Table 16070 - 1 below:

Table 16070 - 1 U-Channel Support Framing Selection

Condition 1	Condition 2	Type
Aboveground	All Locations	Stainless Steel

D. Installing Conduit Supports:
   1. For exterior locations provide malleable iron conduit supports.

E. Field Fabrication:
   1. Tightly fit and secure joints.
      a. Make exposed joints butt tight, flush, and hairline.
      b. Weld fabricated assemblies in accordance with AWS D1.1/D1.1M.
         1) Continuously seal joined members using intermittent welds and plastic filler.
         2) Dress welds smooth and free of sharp edges and corners.
      c. Grind exposed joints flush and smooth with the adjacent finish surface.
   2. For the attachment of work and for bolted connections, accurately drill or punch holes for the fasteners as required.
      a. Burned holes are unacceptable.
      b. Provide holes no more than 3/32-inch larger than the fasteners.
   3. Exposed Mechanical Fastenings:
      a. Except where specifically noted otherwise in the Contract Documents, provide flush countersunk screws or bolts; unobtrusively located, and consistent with the design of the component.
   4. Fabrication Tolerances:
      a. Squareness: 1/8 inch (3 mm), maximum difference in diagonal measurements.
      b. Maximum offset between faces: 1/16 inch (1.5 mm).
      c. Maximum misalignment of adjacent members: 1/16 inch (1.5 mm).
      d. Maximum bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
      e. Maximum deviation from plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

3.04 FIELD QUALITY CONTROL

A. Inspection:
   1. Verify the adequacy of coatings.
   2. Inspect the items provided under this Section for adherence to the fabrication tolerances specified above, and correct any discrepancies:

3.05 PROTECTION

A. Protect the items provided under this Section from damage during the work of other trades.

END OF SECTION

SECTION 16075

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Requirements for furnishing, installing, and protecting identification signs and labels for electrical systems.

B. Related Section:
   1. Refer to Procurement Documents.
   2. Section 16050 Common Work Results for Electrical
   3. Section 16120 Low Voltage Electrical Power Conductors and Cables
   4. Section 16130 Conduit for Electrical Systems
   5. Section 16131 Wireways for Electrical Systems
   6. Section 16132 Boxes for Electrical Systems

1.02 REFERENCES

A. Reference Standards:
   1. U. S. Government:
      a. Federal Transit Administration (FTA):
         1) 49 CFR 661 Buy America Requirements.

B. National Electrical Manufacturer's Association (NEMA):
   1. NEMA 250, Enclosures for Electrical Equipment.

C. National Fire Protection Association (NFPA):
   1. NFPA 70, National Electrical Code (NEC).
   2. NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces.

D. U. S. Government:
   1. Code of Federal Regulations (CFR)
      a. 29 CFR 1910 Occupational Safety and Health Standards.

1.03 DEFINITIONS

A. Mimic bus refers to a graphical representation of the devices and bus work within an item of electric equipment.

1.04 SUBMITTALS

A. Submit the following information for approval in accordance with the requirements of the Procurement Documents and Section 16050:
   1. Product Data:
      a. Provide catalog cuts for the actual products provided, and indicate clearly the usage of each product.

1.05 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Buy America Act:
      a. Except for those products which are exempt under the specific statutory waivers stipulated in 49 CFR 661, all other products supplied under this Section must comply with the requirements of the Buy America Act.

B. Regulatory Requirements:
   1. Comply with the all applicable requirements of OSHA, but particularly those stated in 29 CFR 1910.144 and 29 CFR 1910.145.
   2. Comply with the requirements of NFPA 70E that are applicable to electrical identification items as listed below in this Specification Section.

1.06 DELIVERY, STORAGE AND HANDLING

A. Protect items from damage during delivery, storage, and handling in accordance with Section 16050 and as detailed below.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide products meeting the specified requirements from one of the following manufacturers, unless otherwise indicated:
   1. Brady Worldwide, Inc., P. O. Box 2131, Milwaukee, WI 53201-2131, Telephone (414) 358-6600.
   2. Seton Identification Products, 20 Thompson Road, P. O. Box 819, Branford, CT 06405-0819, Telephone (800) 243-6624.
   3. LEM Products, Inc.; P. O. Box 190, 4089 Landisville Road, Doylestown, PA 18901, Telephone (800) 220-2400 or (215) 348-9900.

B. To serve as examples of the quality required of the specified products, several Brady Worldwide, Inc. Product Numbers are listed for informational purposes only.

2.02 MATERIALS

A. Laminated Phenolic or Plastic:

1. Provide rigid, thermosetting resin or polymer material that is heat- and fire-resistant, abrasion resistant, electronically non-conductive, and non-corroding.
2. Extrude the thermosetting resin or polymer into sheets, and laminate the sheets together so that colored top and bottom layers sandwich a contrasting color core in the middle.

B. Mounting Hardware:
1. Provide number10 hex-head machine screws and lock-washers, or hex-head bolts, lock-washers, and nuts for mounting identification nameplates onto electrical equipment.
2. Provide either type 316 stainless steel or brass fasteners; however, all fasteners used on the same nameplate must be of the same material.

2.03 EQUIPMENT IDENTIFICATION NAMEPLATES

A. Provide laminated phenolic or plastic equipment identification nameplates having beveled edges and engraved lettering.
1. Drill holes for mounting hardware in the equipment identification nameplates as follows:
a. For nameplates that are more then 2 inches wide, drill four holes.
b. For nameplates that are more than 1-1/2 inches high, drill four mounting holes.
c. For smaller nameplates, drill holes for two fasteners.
2. Provide equipment identification nameplates long enough to ensure that the heads of fastening hardware do not extend beyond the nameplate material, and come no closer than 1/16-inch to the nearest letter of the nameplate legend and no closer than 1/16-inch to the nearest edge.

B. Engrave equipment identification nameplates with all capital, Helvetica Medium font, or equal, lettering.
1. Provide white nameplate lettering centered on black backgrounds, except for warning nameplates provide white lettering centered on red backgrounds.
2. Provide a minimum 1/8-inch border between the nameplate lettering and the tops and bottoms of the nameplates.
3. Use 3/8-inch high letters for the first line, and 1/4-inch letters for succeeding lines; except, in cases where the tag will not fit because the equipment is too small, use 3/16-inch letters for the first line and 1/8-inch letters for succeeding lines.

PART 3 EXECUTION

3.01 INSTALLATION

A. Wiring Identification:
1. Identify wiring in conformance with the requirements of Section 16120.

END OF SECTION

SECTION 16080

ACCEPTANCE OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: The work specified in this Section consists of materials to performance test electrical systems and equipment.
   1. Items Supplied Under This Section:
      a. Electrical System Testing

B. Related Sections:
   1. Refer to Procurement Documents.
   2. Division 16 Sections, As Applicable

1.02 REFERENCES

A. Reference Standards:
   1. U. S. Government:
      a. Federal Transit Administration (FTA):
         1) 49 CFR 661 Buy America Requirements

B. Applicable Documents and Testing Requirements of:
   1. National Fire Protection Association (NFPA), as applicable, including:
      a. NFPA 70 - National Electrical Code (NEC).
      b. NFPA 70E - Electrical Safety Requirements for Employee Workplaces.
   2. State and Local Codes and Ordinances as applicable.

1.03 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Buy America Act:
      a. Except for those products which are exempt under the specific statutory waivers stipulated in 49 CFR 661, all other products supplied under this Section must comply with the requirements of the Buy America Act.

1.04 GENERAL REQUIREMENTS

A. Refer to Procurement Documents.

B. Field Inspection:

1. This Contractor is responsible for a complete inspection of all equipment, prior to testing and energizing to ascertain that it is free from any damage, scratches, or missing components and that all power connections are correct, and that they are tight in conformance with recommended standard practice. The inspection is to also include a check of control wiring, terminal connections and all bolts and nuts.
2. Perform field inspection by this Contractor during a time when the Authority is present to witness each inspection and its performance.
3. Correct any deficiencies found during the inspection by this Contractor prior to the energizing and testing of the equipment.

1.05 SCHEDULING

A. Schedule all testing with work of other contractors to ensure an orderly sequence of startup and completion of work.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 ELECTRICAL INSPECTIONS AND TESTS

A. Perform, supervise, and furnish all test equipment needed to perform tests and provide safety measures, procedures and equipment required for each test.

B. Schedule all testing with the Authority. Perform testing in the presence of the Authority except when the Authority approves in writing conducting a specific test without the Authority's presence.

C. Notify all involved parties including the Authority prior to tests, advising them of the test to be performed and the scheduled date and time. D. Coordinate the tests with others involved.

E. Safety and Precautions:

1. Safety practices are to include, but are not limited to, the following requirements:
   a. Occupational Safety and Health Act of 1970-OSHA.
   b. Accident Prevention Manual for Industrial Operations, National Safety Council, Chapter 4.
   c. Applicable State and Local safety operating procedures.
   d. IETA Safety/Accident Prevention Program.

e. Authority's safety practices.
f. National Fire Protection Association - NFPA 70E.

2. Perform all tests with apparatus de-energized except where otherwise specifically required.

3.02 TESTING TO BE PERFORMED BY THE CONTRACTOR

A. Continuity Test: Make test for continuity and correctness of wiring and identification on all conductors installed.

3.03 CORRECTION OF DEFICIENCIES

A. Report all unacceptable values immediately. Correct all deficiencies found in work of this contract and separately report deficiencies in work of items of other contracts.

1. Retest items requiring correction. Correct or have corrected any remaining deficiencies and retest until work is acceptable.

END OF SECTION

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SECTION 16120

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Requirements for furnishing, installing, connecting, energizing, testing, cleaning, and protecting low voltage cable, shielded cable, and accessories.

B. Related Sections:
   1. Procurement Documents
   2. Section 16050 Common Work Results for Electrical
   3. Section 16060 Grounding and Bonding for Electrical Systems
   4. Section 16075 Identification for Electrical Systems
   5. Section 16080 Acceptance of Electrical Systems
   6. Section 16130 Conduit for Electrical Systems
   7. Section 16131 Wireways for Electrical Systems
   8. Section 16132 Boxes for Electrical Systems

1.02 REFERENCES

A. Reference Standards:
   1. U. S. Government:
      a. Federal Transit Administration (FTA):
         1) 49 CFR 661 Buy America Requirements.

B. National Electrical Manufacturer's Association (NEMA):
   1. NEMA WC 26/EEMAC 201 - Binational Wire and Cable Packaging Standard.

C. American Society for Testing Materials (ASTM):
   1. ASTM B 8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

D. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC).

E. Underwriter's Laboratories, Inc. (UL):
   1. UL 13 - Standard for Power-Limited Circuit Cables.
   2. UL 1581 - Reference Standard for Electrical Wires, Cables, and Flexible Cords.

1.03 DESIGN REQUIREMENTS

A. Conductors in Raceway and Conduit Systems:
   1. Provide conduit systems for installing the wiring that is outside of equipment.
   2. Except for raceway or conduit for control wires or where otherwise indicated on the Contract Drawings, design raceway and conduit systems so that the maximum number of low-voltage conductors in each raceway or conduit does not exceed 4, including three phase conductors and one neutral, plus a ground.

B. Product Data and Catalog Cuts:
   1. Submit low-voltage ground, power, and control wiring product data as listed below for the products provided as the Work of this Section; and clearly indicate the usage of each product on the data submitted.
      a. Wires and cables.
      b. Lugs.
      c. Connectors.
      d. Tapes.
      e. Pulling lubricant.

C. Use of Trade Names:
   1. The use of trade names within the Contract Documents is intended to establish the basis of design and to illustrate the constructability and level of quality required.
      a. The use of trade names is not intended to exclude other manufacturers whose products are equivalent to those named, subject to compliance with Contract requirements.

1.04 SUBMITTALS

A. Submit the following information to the Engineer for approval in accordance with the requirements of the :
   1. Product Data:
      a. Wires and cables.
      b. Lugs
      c. Connectors.
      d. Tape.
      e. Pulling lubricant.
   2. Quality Assurance/Control Submittals:
      a. Certificates.
         1) Testing agency/quality verification.
      b. Manufacturers Instructions.
         1) Cable manufacturer’s recommendations.
      c. Qualification Statements.
         1) Documented experience of the installing firm.
         2) Qualifications of the licensed electricians supervising the Work.

1.05 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Buy America Act:
      a. Except for those products which are exempt under the specific statutory waivers stipulated in 49 CFR 661, all other products supplied under this Section must comply with the requirements of the Buy America Act.

B. Qualifications:
   1. Installer Qualifications:
      a. To install the Work of this Section, employ the services of a firm specializing in installing wire, cable, and accessories, and that has a minimum of 3 years experience doing so.
         1) Submit the documented experience of the firm installing the wire, cable, and accessories.
      b. To supervise installation of the Work of this Section, employ licensed electricians.
         1) Submit the qualifications of the licensed electricians supervising the Work of this Section.

C. Regulatory Requirements:
   1. Perform the Work of this Section in accordance with the requirements specified in NFPA 70, and to all other applicable state, local, and national governing codes and regulatory requirements.

D. Certifications:
   1. Provide products that are listed and labeled by Underwriters Laboratory, approved by Factory Mutual, or certified as meeting the standards of UL by the Electrical Testing Laboratory (ETL) for the location installed in, and the application intended, unless products meeting the requirements of these testing laboratories are not available or unless standards do not exist for the products.
      a. Provide copper conductors listed and labeled by UL for all wiring.
   2. Submit evidence of testing agency/quality verification, listing, and labeling for each product with the submitted product data either by providing a printed mark on the data or by attaching a separate listing card.

1.06 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
   1. Imprint insulated conductors with the date of manufacture, the wire type, and the manufacturer.
   2. Package wire and cable in conformance with the requirements of NEMA WC 26/EEMAC 201.
   3. Protect items from damage during delivery, handling, and installation.

a. Comply with the cable manufacturer's recommendations for inspection, handling, storage, temperature conditioning, bending and training limits, pulling limits, and calculation parameters for installing cable.
b. Submit the cable manufacturer's recommendations for inspection, handling, storage, temperature conditioning, bending and training limits, pulling limits, and calculation parameters for installing cable

B. Acceptance at Site:
1. Wire and cable manufactured more than 12 months before delivery to the Site is unacceptable for use under this Contract, and will be rejected.

C. Storage and Protection:
1. Store products indoors on blocking or pallets.
2. Protect items from damage during storage.

PART 2 PRODUCTS

2.01 LOW VOLTAGE CONDUCTORS

A. Conductor Design Requirements:
1. Provide conductors of the proper size and ampacity ratings based on Article 310 of NFPA 70.
a. Provide copper conductors that have 98 percent conductivity.
b. Unless otherwise indicated on the Contract Drawings, at a minimum provide conductors of the following American Wire Gauge (AWG) sizes:
1) For power and branch feeder circuits: 12 AWG.
a) For power and branch feeders, provide solid copper low-voltage conductors for sizes up to and including 10 AWG, provide stranded copper low-voltage conductors for 8 AWG and larger sizes.
2) For control circuits: 14 AWG.
3) For alarm and status circuits: 14 AWG.
4) For single conductor instrument wiring: 14 AWG.
5) For multiple conductor instrument wiring: 16 AWG.

B. Insulation Design Requirements:
1. Provide low voltage ground, power, and control wiring having the proper insulation types as follows, unless noted otherwise on the plans:
a. Above Ground
1) Feeders & Branch Circuits
a) All locations: Type XHHW-2

C. Manufacturers
1. Acceptable Manufacturers:
a. Cablec Continental Co.
b. SouthWire.

c. Okonite Co.
d. Rome Cable Corp
e. Or Approved Equal

2.02 MATERIALS

A. Cable Lubricant:
1. Provide cable lubricant specifically recommended by the cable manufacturer for cable pulling operations.
a. For rubber of plastic jacketed cables, provide soapstone, graphite, or talc cable lubricant.

B. Grounding Braid:
1. Provide conformable, all-metal (tinned copper wires), corrosion resistant, woven grounding braid having a high current-carrying capacity approximately that of 6 AWG wire.
2. Manufacturers:
a. 3M, Scotch, Scotch® 25 Electrical Grounding Braid, http://solutions.3m.com/portal/3M/en_US.
b. Plymouth, www.plymouthrubber.com.
c. Permacel, www.permacel.com.
d. Or Approved Equal.

C. Tapes:
1. Vinyl Insulating Tape:
a. Provide UL-listed flexible polyvinyl chloride (PVC) backed insulating tape with a pressure sensitive adhesive, such as black Scotch® 33+ Vinyl Electrical Tape, that is resistant to abrasion, acids, alkalis, and copper corrosion; resistant to, hot, cold and wet weather; and resistant to damage from UV sunlight exposure.
2. Manufacturers:
a. 3M, Scotch, http://solutions.3m.com/portal/3M/en_US.
b. Plymouth, www.plymouthrubber.com.
c. Permacel, www.permacel.com.
d. Or Approved Equal.

D. Tubing:
1. Heat Shrinkable Tubing:
a. Provide flexible, flame retardant, polyolefin heat shrinkable thin wall tubing that has good resistance to common fluids and solvents, and has a high dielectric strength.
2. Waterproof Splice Kits:
a. Provide heat shrinkable thin wall polyolefin electrical cable splice kits.
3. Manufacturers:
a. Tyco Electronics, CGPT, http://catalog.tycoelectronics.com.

b. Thomas & Betts Corp., www.tnb.com.
c. Or Approved Equal.

E. Wire and Cable Connections:
1. Grounding Connectors:
a. Provide grounding connectors conforming to the requirements of Section 16060, Grounding and Bonding.
2. Connectors for Service Wires and Cables, and for Wires and Cables Larger Than Number 6:
a. Split Bolt Connectors or Compression Type Connectors:
1) Provide UL-listed split bolt connectors or compression type connectors for making parallel or butt splices of stranded copper wire.
2) Use companion preformed plastic insulating covers or tape insulation conforming to NFPA 70 (NEC) requirements.
b. Mechanical compression connectors:
1) Provide mechanical compression connectors that are capable of connecting single or multiple conductors, and of being installed with one wrench.
a) Type: Compact, two-hole mechanical compression connectors having two clamping bolts.
(1) Connector Body: Provide a high copper bronze or brass alloy body.
(2) Bolts: Provide brass or bronze bolts; plated steel screws are unacceptable.
(3) Fasteners: Provide silicon-bronze fasteners for bolting connectors to connections.
3. Connectors for Other Conductors:
a. Any of the applicable types listed for larger wire may be provided.
b. Wire Nuts:
1) For making splices of copper wire, provide pre-insulated, UL-listed, solderless connectors of the spring-lock or compression type that can be installed by hand or using tools.
c. Manufacturers:
1) Thomas & Betts Corp., www-public.tnb.com/ps/pubint.
2) Tyco Electronics, AMP Inc., www.amp.com.
3) Ilsco Corp., http://ilsco.com.
4) FCI-Burndy® Products, https://portal.fciconnect.com.
5) Or Approved Equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect all conduits, junction boxes, electrical vaults, and handholes to verify that they are clean, that they do not have burrs, that conduits are properly aligned, and that they are complete.
   1. Ensure that on all conduits without threaded hubs, two locknuts are installed.
   2. Ensure that in all conduits with wires larger than No. 10, bushings are installed.
   3. Ensure that grounding bushings and fittings are installed at all places specified in Section 16060, Grounding and Bonding for Electrical Systems.
   4. Verify that proper sized boxes are installed.

B. Verify that boxes and conduit fittings conform to the bending requirements specified in Article 314 of NFPA 70 (NEC).

3.02 PREPARATION

A. Verify that pulling calculations have been made and are available for long conduit runs and pulls as indicated in this Section.

B. Do not begin installing wiring until other work which might cause damage to the wires, cables, or conduits has been completed.
   1. Correct deficiencies in conduits and junction boxes that have been discovered by the inspection required in Paragraph 3.02.A.

C. Prepare conduits to receive wire and cable.
   1. Swab the conduits with a nylon brush and steel mandrel.
   2. Pre-lubricate the conduits for which the pulling tension calculations are based on a coefficient of friction less than that of a dry conduit.

D. Verify that a means of controlling the pulling tension on the wire or cable is installed on the mechanical assist devices furnished for pulling cable.

E. Take the necessary precautions to prevent water, dirt, or other foreign material from accumulating in the conduits during the execution of wiring work.

3.03 INSTALLATION

A. Low Voltage Ground, Power, and Control Wiring:
   1. Neutral Conductors:
      a. For each single-phase and each multi-phase feeder, provide separate neutrals.
   2. Equipment Ground Conductors:
      a. Provide a green equipment ground conductor with all runs.

1) Provide the equipment ground conductor wire type as specified in Section 16060, Grounding and Bonding for Electrical Systems.

B. Terminating Cable:
   1. Terminate cable using materials and methods indicated or specified herein, or in accordance with the written instructions of the cable manufacturer or termination kit manufacturer.
      a. For equipment connections, provide split bolt or compression type connectors, mechanical compression connectors, or crimped compression type connectors as specified and approved by the equipment manufacturer; for all other types of connections provide connectors of one of the types specified:
   2. Protect insulated power and lighting cable terminations from accidental contact, deterioration of coverings, and moisture by using proper terminating devices and materials.

C. Splicing Wire and Cable:
   1. Only splice cables in accessible locations.
   2. Within outlet or junction boxes, make wire and cable splices that conform to the requirements of NFPA 70 (NEC).

D. Wiring Identification:
   1. Color code all feeder wires and cables as indicated in Table 16120 - 1.

Table 16120 - 1 Feeder Wire and Cable Color Coding

Phase	480Y/277 Volts	208/120 Volts
A	Brown	Black
B	Orange	Red
C	Yellow	Blue
Neutral	Gray or White with Yellow Tracer	White
Electrical Ground Conductor	Green	Green

END OF SECTION

SECTION 16130

CONDUITS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Requirements for furnishing, installing, energizing, and testing conduit, tubing, and fittings for communication lines and electrical transmission, distribution, and service lines.

B. Related Section:
   1. Refer to Procurement Documents
   2. Division 2 Existing Conditions
   3. Division 3 Concrete
   4. Section 16050 Common Work Results for Electrical
   5. Section 16060 Grounding and Bonding for Electrical Systems
   6. Section 16070 Hangars and Supports for Electrical Systems
   7. Section 16080 Acceptance of Electrical Systems

1.02 REFERENCES

A. Reference Standards:
   1. U. S. Government:
      a. Federal Transit Administration (FTA):
         1) 49 CFR 661 Buy America Requirements.

B. American National Standards Institute (ANSI):
   1. ANSI/ASME B1.20.1 - Pipe Threads, General Purpose (Inch).
   2. ANSI C80.1 - Rigid Steel Conduit - Zinc-Coated (GCR).

C. American Society for Testing and Materials (ASTM):
   1. ASTM A 568/A 568M - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold Rolled, General Requirements (Refer to Procurement Documents).

D. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC).

E. Underwriters Laboratory, Inc. (UL):
   1. ANSI/UL 6 - Standard for Rigid Metal Conduit.
   2. ANSI/UL 360 - Standard for Liquid-Tight Flexible Steel Conduit.
   3. ANSI/UL 498 - Standard for Safety for Attachment Plugs and Receptacles.

4. ANSI/UL 514A - Metallic Outlet Boxes.

F. Institute of Electrical and Electronics Engineers (IEEE):
   1. IEEE C2 - National Electrical Safety Code.

1.03 DEFINITIONS

A. Definitions for all items are as stated in NFPA 70, IEEE C2, and in other reference documents unless otherwise stated, specified, or noted.

1.04 DESIGN REQUIREMENTS

A. Conduit Systems:
   1. Provide conduit of the type and material shown in Tables 16130 – 1 below for the application indicated, or as indicated on the Contract Drawings.
      a. In a given location, provide only the type of conduit indicated or scheduled for that location.
   2. Provide conduit fittings made of material identical to that of the conduit system with which they are used.

Table 16130 - 1 Conduit System Selection

Location	Condition 1	Condition 2	Conduit Type	Minimum Size
Above Ground	All Locations	Recess Mounted Lighting Fixtures and Rotating or Vibrating Equipment & Expansion Joints	Liquidtight Flexible Metal Conduit	3/4 Inch
		Exposed Other Locations	Rigid Galvanized Steel	3/4 Inch

1.05 SUBMITTALS

A. Submit the following information to the Authority for approval in accordance with the requirements of the Procurement Document:
   1. Product Data:
      a. Liquidtite flexible metal conduit.
      b. Rigid galvanized steel conduit (RGS).
      c. Fittings for metallic conduit systems.
      d. Conduit spacers.
      e. Heat shrink tubing.
      f. Cold galvanize coating.
   2. Quality Assurance/Control Submittals:

a. Qualification Statements:
   1) Qualifications of the installer.
b. Certificates:
   1) Testing agency/quality verification, listing, and labeling.

1.06 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Buy America Act:
      a. Except for those products which are exempt under the specific statutory waivers stipulated in 49 CFR 661, all other products supplied under this Section must comply with the requirements of the Buy America Act.

B. Qualifications:
   1. Installer Qualifications:
      a. Employ an installation firm with a minimum of three years documented experience installing conduit and tubing similar in type and scope to that required by this Contract to install the Work of this Section.
      b. Employ skilled licensed electricians to supervise the Work of this Section.
      c. Submit information verifying the installer's qualifications.

C. Regulatory Requirements:
   1. Perform the Work of this Section in accordance with the requirements specified in NFPA 70 (NEC), and to other applicable state, local, and national governing codes and regulatory requirements.

D. Certifications:
   1. Provide products that are listed and labeled by Underwriters Laboratory, approved by Factory Mutual, or certified as meeting the standards of UL by the Electrical Testing Laboratory (ETL) for the location the product is installed in, and the application intended, unless products meeting the requirements of these nationally recognized testing laboratories are not available or unless standards do not exist for the products.
      a. Submit evidence with the Product Data that the products represented meet testing agency quality verification requirements, including agency listing and labeling requirements.
         1) Such evidence may consist of either a printed mark on the data or a separate listing card.

1.07 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
   1. Pack, ship, handle, and unload products in accordance with the requirements of Section 16050, Common Work Results for Electrical, and as detailed herein.

B. Acceptance at Site:
   1. Acceptance products at the Site in accordance with the requirements of Section 16050, Common Work Results for Electrical, and as detailed herein.

C. Storage and Protection:
   1. Store products in accordance with the requirements of Section 16050, Common Work Results for Electrical, and as detailed herein.
      a. Store all products indoors on blocking or pallets.

PART 2 PRODUCTS

2.01 METALLIC CONDUIT

A. Liquidtite Flexible Metal Conduit:
   1. Provide PVC coated flexible metal conduit conforming to the requirements of Article 350 of NFPA 70 (NEC) for materials and uses and ANSI/UL 360.
   2. Provide conduit with interlocking spiral strip construction capable of bending to a minimum radius of five times its diameter without deforming the spiral strips both inside and outside of the conduit.
      a. Provide conduit with a flexible, galvanized, interlocking spiral strip steel core jacketed with smooth, liquid-tight polyvinyl chloride designed to withstand temperatures from minus 40 degrees Celsius to plus 60 degrees Celsius.
   3. Finish the interior and exterior of flexible conduit smooth and free from burrs, sharp edges, and other defects that may injure wires; and place the manufacturer's trademark on each length.
   4. Furnish an integral continuous copper ground in 1/2-inch through 1-1/4-inch PVC coated flexible metal conduit.
   5. Acceptable Manufacturers
      a. Electri-Flex Company, Liquatite®, Type LA, www.electriflex.com.
      b. ANAMET Electrical, Inc., Anaconda Sealtite®, www.anacondasealtite.com.
      c. Or Approved Equal.

B. Rigid Galvanized Steel Conduit (RGS):
   1. Provide rigid galvanized steel conduit (RGS) conforming to the requirements of Article 344 of NFPA 70 (NEC) for materials and uses, ANSI C80.1, and UL 6.
   2. Fabricate the RGS from mild steel piping, galvanized or sherardized inside and outside, and protected against corrosion by a dichromate rinse or a zinc chromate coating.
   3. Provide defect free conduit bearing the UL label, and furnished in 10-foot minimum lengths with both ends threaded and one end fitted with a coupling.
      a. Provide tapered NTP 3/4 inch per foot threads complying with ANSI/ASME B1.20.1.
   4. Acceptable Manufacturers:
      a. Tyco/Allied Tube and Conduit, www.alliedtube.com.

b. Wheatland Tube Company, Division of John Maneely Company, www.wheatland.com.
c. Or Approved Equal.

2.02 CONDUIT FITTINGS

A. Fittings for Metallic Conduit Systems:
1. Construct conduit bodies/fittings from cast malleable iron or cast steel.
2. Conduit Outlet Bodies:
a. Provide malleable iron threaded entry type conduit outlet bodies with neoprene gaskets and cast steel conduit.
b. Acceptable Manufacturers:
1) EGS/Appleton Electric, www.appletonelec.com.
2) EGS/O-Z/Gedney, www.o-zgedney.com.
3) Or Approved Equal.
3. Conduit Expansion Joints:
a. Provide telescoping sleeve type galvanized, weatherproof, and vapor tight conduit expansion joints designed for 4-inch maximum expansion with an insulated bushing and lead-wool packing.
b. Acceptable Manufacturers:
1) EGS/Appleton Electric, www.appletonelec.com.
2) EGS/O-Z/Gedney, www.o-zgedney.com.
3) Or Approved Equal.
4. Conduit Unions:
a. Provide conduit unions capable of completing a conduit run when neither conduit end can be turned.
b. Acceptable Manufacturers:
1) EGS/Appleton Electric, UNF and UNY Unions, www.appletonelec.com..
2) Thomas and Betts Company, Erickson® Coupling., www.tnb.contractor/docs/tnbhazardous.pdf.
3) Or Approved Equal.
5. Conduit Outlet Boxes:
a. Provide malleable or cast iron conduit outlet boxes conforming to the requirements of UL 886, and having a cover with O-rings to keep out moisture.
b. Acceptable Manufacturers:
1) EGS/Appleton Electric, GRF outlets and covers, www.appletonelec.com.
2) EGS/O-Z Gedney, www.o-zgedney.com.
3) Or Approved Equal.
6. Conduit Device Boxes:
a. Provide malleable iron conduit device boxes with internal grounding screws and conforming to the requirements of UL 498 and UL 514A.
b. Acceptable Manufacturers:
1) EGS/Appleton Electric, FD device boxes, www.appletonelec.com.

2) EGS/O-Z Gedney, www.o-zgedney.com.
3) Or Approved Equal.

7. Conduit Sealing Fittings:
   a. Provide, triple coated, malleable iron conduit sealing fittings.
      1) Coat the conduit sealing fittings with zinc electroplate, dichromate, and an epoxy powder coat.
   b. Provide drain fittings in conduit sealing fittings where required.
   c. Provide sealing covers for junction boxes where required.
   d. Acceptable Manufacturers:
      1) EGS/Appleton Electric, www.appletonelec.com.
         a) Sealing hubs: ES.
         b) Sealing fittings: EYSEF, EYSDEF, and EYD.
      2) EGS/O-Z Gedney, www.o-zgedney.com.
      3) Or Approved Equal.

2.03 HEAT SHRINK TUBING

A. Provide all-weather corrosion resistant vinyl plastic heat shrink tubing designed for application on the exterior of metallic conduit to protect against galvanic action, moisture or other deteriorating contaminants.

B. Manufacturers:
   1. Tyco Electronics, Raychem, www.raychem.com.
   2. Thomas & Betts
   3. Or Approved Equal.

2.04 FINISHES

A. Cold Galvanize Coating:
   1. Provide a cold galvanize coating to provide protection against corrosion by forming an insoluble zinc salt barrier from a cathodic reaction when the coating is damaged by abrasion and exposed to weather.
      a. Provide a single component pre-mixed liquid organic zinc compound producing 95 percent zinc in the dry film.
      b. Provide a coating that bonds to clean iron, steel, or aluminum through electrochemical action.
   2. Acceptable Manufacturers:
      a. ZRC. Worldwide, www.zrcworldwide.com.
      b. Clearco
      c. Krylon
      d. Rustoleum
      e. Or Approved Equal

PART 3 EXECUTION

3.01 EXAMINATION

A. Although the Contract Drawings are generally indicative of the Work, take field measurements to verify actual conditions.
   1. Due to the small scale of the Contract Drawings it is not possible to indicate all offsets, fittings, and apparatus required or the minor structural obstructions that may be encountered during the Work.

B. Inspect the condition of existing conduit that is required for the Work of this Section.

3.02 PREPARATION

A. After carefully investigating structural and finish conditions and other in-place construction work.
   1. Layout the electrical work according to accepted standard electrical trade practice to suit actual field measurements.
   2. Arrange the electrical work to consider existing conditions and to preserve access to other equipment, rooms, areas, and similar features of the construction.

B. Submit Product Data and catalog cuts for all products provided under this Section.
   1. Clearly indicate the usage of each product on the submittal.
   2. Include Product Data for the conduit and tubing provided under this Section.

C. Obtain roughing-in dimensions of electrically operated equipment, including equipment being installed by both electrical and other construction trades.
   1. Set conduit and boxes only after receiving approved dimensions and checking such equipment locations.

D. Remove dirt, debris, and other obstructions from existing conduit required for the Work of this Section by blowing out and mandreling the conduits as applicable.

3.03 INSTALLATION

A. Perform the Work of this Section as specified in Section 16050, Common Work Results for Electrical.

B. Fabricate and install conduit and wireway systems in accordance with accepted electrical trade standard practice.
   1. Layout the electrical work of this Section to suit actual field measurements.
   2. Install the electrical Work of this Section in conformance to the wiring methods general requirements (Refer to Procurement Documents) of Article 300 in NFPA 70 (NEC), and to all other applicable Articles of NFPA 70 governing wiring methods.

3. Cut conduit and wireway square, and ream the cut ends according to the requirements of NFPA 70 (NEC) to deburr the openings so that they are not restricted more than cuts made by the material manufacturer.
4. Avoid bending conduits as much as possible and practical; but if bends are made, use an approved conduit bending tool or machine to make the bends.
5. Do not install crushed or deformed conduit, and remove crushed or deformed conduit from the Site.
6. On conduit that is installed outside, provide a second equipment ground conductor and use fittings with a built-in ground lug for bonding.
7. Provide flexible conduit only to the extent permitted by NFPA 70 (NEC).
    a. In flexible conduits that do not have an integral ground wire, install a green insulated wire in addition to the neutral wire for grounding purposes.
        1) Form a 'J' or 'S' hook with a drip loop to allow flexibility.
        2) Provide a second equipment grounding conductor on outside conduit and provide fittings with built-in ground lug for bonding.
    b. In exposed areas, use PVC coated flexible metal conduit and fittings.
    c. Use liquid tight flexible metal conduit for final connection to recessed lighting fixtures and rotating and vibrating equipment.
        1) Liquid tight flexible metal conduit, as herein specified, for final connection to recess mounted lighting fixtures in unconditioned spaces and to all rotating and vibrating equipment.
        2) Flexible conduit not to exceed 36 inches in length for equipment connections or 72-inches for lighting fixture connections.
8. Provide fittings and apparatus as required to construct the approved electrical design.
    a. Running threads on conduit are not permitted.
        1) Where couplings and connectors are required for metal conduits, use approved threaded couplings and connectors.
    b. Provide conduit unions where necessary to complete a conduit run when neither conduit end can be turned.
    c. Where conduit and raceway runs cross building expansion joints, make provision for expansion in the conduit and raceway runs.
    d. Provide sealing fittings with drain fittings in all lower runs and vertical runs.
    e. Provide sealing covers for junction boxes where required.
    f. Provide weatherproof conduit hubs on all conduit connections.
9. Installing RGS Conduit:
    a. Install RGS conduit using methods and techniques recommended by the conduit manufacturer.
    b. Threading Conduit:
        1) Field thread the conduits per the manufacturer's instructions.

C. Exposed Work:

1. In exposed work, run conduit and raceway parallel to centerlines and structure surfaces; or perpendicular to centerlines where required, with right angle turns consisting of symmetrical bends or fittings.
2. Maintain at least 6 inches clearance between conduit and raceway runs and pipes, ducts, and flues of mechanical systems.
3. If a portion of a metallic conduit run is exposed to personnel, ensure that the conduit is properly bonded to an equipment grounding conductor at both ends.
   a. Install the equipment grounding conductor either inside or outside the box.

D. Hangers and Supports:
   1. Install auxiliary support structures, anchors, and fasteners as specified in Section 16070 Hangars and Supports for Electrical Systems.
      a. Mount or suspend conduit and wireway systems directly on structural members of the structures and walls.
      b. Securely attach anchors into walls.
   2. At all conduit attachments, allow space between the mounting surfaces and the conduit by providing U-channel supports, clamp-backs, or spacers.
      a. Attach wall-mounted conduit runs close to the walls following the contour of the walls, parallel to the walls and other building lines except at bends.

E. Wiring:
   1. Install wiring in conduit as indicated.
   2. Prior to the installation of any wire, verify that the conduit is clean and free of debris.
   3. Install a separate ground conductor in all coated flexible metal conduit.

3.04 FIELD QUALITY CONTROL

A. Inspection:
   1. Inspect installed conduit runs for obstructions, proper support, proper grounding, and completeness.

END OF SECTION

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SECTION 16131

WIREWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: The work specified in this Section consists of constructing the metallic raceway systems for the project.

B. Related Sections:
   1. Section 16050 Common Work Results for Electrical
   2. Section 16070 Hangers and Supports for Electrical Systems

1.02 REFERENCES

A. Reference Standards:
   1. U. S. Government:
      a. Federal Transit Administration (FTA):
         1) 49 CFR 661 Buy America Requirements.

B. Federal Specifications:
   1. Fed. Spec W-C-582, Conduit, Raceway, Metal, and Fittings, Surface.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's catalog cuts for the following materials:
   1. Wireway and Fittings.

1.04 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Buy America Act:
      a. Except for those products which are exempt under the specific statutory waivers stipulated in 49 CFR 661, all other products supplied under this Section must comply with the requirements of the Buy America Act.

B. Product Quality Control:
   1. Manufacturers shall fabricate their products in such a manner that all criteria for appearance, fit and tolerances shall be complied with.
   2. Each manufacturer shall carefully control his operations to ensure that the engineering, quality, safety and reliability of product are achieved.

PART 2 PRODUCTS

2.01 WIREWAY SYSTEM MATERIALS

A. Wireway (Raintight, NEMA Type 3R): Lengths, connectors and fittings UL listed and constructed in accordance with Underwriters Laboratories Standard UL 870 for Raintight Wireways, Auxiliary Gutters and Associated Fittings.
   1. Wireway constructed without knockouts.
   2. Provide gasketing that cannot rip or tear during installation and maintain its raintight capability during the life of the wireway.
   3. 16 gauge galvanneal sheet metal parts provided with corrosion resistant phosphate primer and ASA-49 gray enamel finish.
   4. Acceptable Manufacturers:
      a. Hoffman Engineering Company.
      b. Wiegmann.
      c. Or Approved Equal.

PART 3 EXECUTION

3.01 INSPECTION

A. Carefully investigate the structural and finish condition, as well as other construction work, which may affect the work of this Section. Arrange Electrical Work accordingly and furnish such fittings and apparatus as required to accommodate such conditions and to preserve access to other equipment, rooms, areas, etc.

B. Prior to performance of work described above, make detailed drawings of proposed departures from original design due to field conditions or other cause, and submit for Engineer's approval.

C. Inspect installed wireways and remove obstructions, dirt and debris if present.

3.02 PREPARATION

A. Field Measurement: The Drawings are generally indicative of the work, but due to their small scale, it is not possible to indicate all offsets, fittings, and apparatus required nor the minor structural obstructions that may be encountered.

B. Obtain roughing-in dimensions of electrically operated equipment being installed in other construction work. Set wireways only after receiving approved dimensions and checking such equipment locations.

C. Layout electrical work to suit actual field measurements and according to accepted Trade standard practice. However, electrical installations shall conform to NEC 300

for wiring methods general requirements (refer to Procurement Documents), and to all other applicable Articles of the NEC governing methods of wiring.

3.03 INSTALLATION

A. Methods of Wiring: In general fabricate raceway systems in accordance with accepted Trade standard practice. The following installation requirements are in addition to requirements set forth in Article 300 of the NEC and are included to complement the same.
   1. Cut raceways square and deburr cuts to the same degree as cuts made by the material manufacturer. Ream cuts of conduits per NEC requirements with openings not restricted more than cuts made by the material manufacturer.
   2. Mount or suspend raceway systems directly on structural members of the structures, except where indicated as being wall mounted. Space supports in accordance with NEC requirements.
   3. Attach wall mounted raceway runs tight to walls, following contour of walls and securely attach anchors into walls.
   4. Do not weaken the structure by excessive or unnecessary cutting.
   5. Make provisions for expansion in raceway runs where same cross building expansion joints.

B. Exposed Work: Make raceway runs in exposed work parallel to centerlines and structure surfaces, and perpendicular to centerlines where required, with right angle turns consisting of symmetrical bends or fittings. Maintain at least 6 inches clearance between raceway runs and mechanical systems pipes, ducts, flues, etc.

3.04 ANCHOR AND FASTENER INSTALLATIONS

A. Auxiliary Support Fabrication: As specified in Section 16070.

B. Threaded Bolts: As specified in Section 16070.

C. Drilled-In Expansion Anchor Installation: As specified in Section 16070.

END OF SECTION

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SECTION 16132

BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Requirements for furnishing, installing, connecting, cleaning, and protecting electrical pull and junction boxes.

B. Related Section:
   1. Refer to Procurement Documents
   2. Section 16050 Common Work Results for Electrical
   3. Section 16060 Grounding and Bonding for Electrical Systems
   4. Section 16070 Hangers and Supports for Electrical Systems
   5. Section 16080 Acceptance of Electrical Systems
   6. Section 16120 Low-Voltage Electrical Power Conductors and Cables
   7. Section 16130 Conduits for Electrical Systems

1.02 REFERENCES

A. Reference Standards:
   1. U. S. Government:
      a. Federal Transit Administration (FTA):
         1) 49 CFR 661 Buy America Requirements.

B. National Electric Manufacturer's Association (NEMA):
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable.

C. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC).

D. American National Standards Institute (ANSI):
   1. ANSI Z55.1 - Gray Finishes for Industrial Apparatus & Equipment (*withdrawn 1990, no replacement*).

1.03 DESIGN REQUIREMENTS

A. Product Data:
   1. Submit a list of the materials proposed to satisfy the requirements of this Section.
   2. Submit Product Data and catalog cuts of the materials and equipment proposed to be used to satisfy the requirements of this Section.

1.04 SUBMITTALS

A. Submit the following information to the Engineer for approval in accordance with the requirements of The Procurement Documents:
   1. Product Data:
      a. List of the proposed materials.
      b. Catalog cuts of cast outlet boxes for general purpose applications used with steel conduit systems.
      c. Catalog cuts of equipment and control device enclosures for outdoor
   2. Quality Assurance/Control Submittals:
      a. Certificates.
         1) Testing agency/quality verification, listing, and labeling.
      b. Qualification Statements.
         1) Qualifications of the licensed electricians.

1.05 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Buy America Act:
      a. Except for those products which are exempt under the specific statutory waivers stipulated in 49 CFR 661, all other products supplied under this Section must comply with the requirements of the Buy America Act.

B. Qualifications:
   1. Installer Qualifications:
      a. To supervise installation of the Work of this Section, employ licensed electricians.
         1) Submit the qualifications of the licensed electricians supervising the Work of this Section.

C. Regulatory Requirements:
   1. Perform the Work of this Section in accordance with the requirements specified in Articles 250, 300, and 370 of NFPA 70 (NEC), and to all other applicable state, local, and national governing codes and regulatory requirements.

D. Certifications:
   1. Provide products that are listed and labeled by Underwriters Laboratory, approved by Factory Mutual, or certified as meeting the standards of UL by the Electrical Testing Laboratory (ETL) for the location installed in, and listed and labeled or approved for the application intended as indicated or specified, unless products meeting the requirements of these testing laboratories are not readily available or unless standards do not exist for the products.
      a. Provide products that are approved, listed, and labeled for the short circuit currents, voltages, and currents indicated or specified to be applied.

b. Provide service entrance labeled products for all service entrance equipment.

1.06 MATERIAL DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
   1. Pack, ship, handle, and unload products in accordance with the requirements of Section 16050 Common Work Results for Electrical.

B. Acceptance at Site:
   1. Accept products at the Site in accordance with the requirements of Section 16050 Common Work Results for Electrical.

C. Storage and Protection:
   1. Store products in accordance with the requirements of Section 16050 Common Work Results for Electrical.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Use of Trade Names:
   1. The use of trade names within the Contract Documents is intended to establish the basis of design and to illustrate the constructability and level of quality required.
   2. The use of trade names is not intended to exclude other manufacturers whose products are equivalent to those named, subject to compliance with Contract requirements.

2.02 MANUFACTURED UNITS

A. Enclosures or Pull Boxes for Garage Locations:
   1. Stainless Steel Box
      a. Provide box with continuously welded seams, ground smooth, no holes or knockouts except as required for conduit entry.
      b. Provide screw cover with stainless steel clamps or captivated screws.
   2. Provide oil resistant gasket.
   3. Conform to NEMA 250 for Types 3R and 4 enclosures.
   4. Acceptable Manufacturers:
      a. Hoffman
      b. Rittal Corp
      c. Milbank Manufacturing
      d. Or Approved Equal

B. Cast Outlet Boxes for General Purpose Applications:
   1. For Use with Steel Conduit Systems:

a. For use with steel conduit systems, provide small cast steel or cast malleable iron outlet boxes with threaded hubs that meet the NEMA 250 requirements for Type 12 enclosures.
b. If covers are indicated or specified, provide cast steel or cast malleable iron covers with neoprene gaskets.
    1) Provide captive Type 316 stainless steel mounting screws for the covers.
c. If fixture hangers are indicated or specified, provide ball type cast steel or cast malleable iron fixture hangers with neoprene gaskets.
    1) Provide captive Type 316 stainless steel mounting screws for the fixture hangers.
d. Finish:
    1) Provide outlet boxes, covers, and hangers with an electroplated zinc coating, followed first by a dichromatic prime, and then by an aluminum polymer finish coating conforming to NEMA FB 1.
e. Manufacturers:
    1) EGS/Appleton Electric, www.appletonelec.com.
    2) EGS/O-Z/Gedney, www.o-zgedney.com.
    3) Crouse Hinds
    4) Killark
    5) Or Approved equal.

2.03 SOURCE QUALITY CONTROL

A. NOT USED.

PART 3 EXECUTION

3.01 INSTALLERS

A. Install the work of this Section only under the supervision of licensed electricians.

3.02 EXAMINATION

A. Verify that conduit stub-ups to be mated with electrical boxes and enclosures are the correct type and size, and are at the proper location.

3.03 INSTALLATION

A. Installing Boxes for Electrical Outlets and Devices:
    1. Install boxes level and plumb within 1/16-inch of vertical or horizontal over the length of the box.
    2. When installing boxes outside or to exposed conduit in unfinished areas, provide cast boxes.
        a. Mount these boxes on spacers to be 1/8-inch from wall unless box has built-in raised pads to perform the same function.

3. Support cast boxes for outlet and device using one of the following methods:
   a. Mount the boxes directly to the structure using 4 or more anchors.
      1) Attach mounting screws to feet located outside of the box interior.
      2) Provide 1/4-inch spacers behind the boxes unless the box has raised pads.
   b. Attach the box to two 1-inch or larger conduits which are supported within 12-inches of the box.
   c. Attach the box to two 1-inch or larger conduits which exit from a poured concrete floor no further than 18-inches from the box.

B. Installing Pull and Junction Boxes for Other than Electrical Outlets and Devices:
   1. Accurately punch holes for conduit openings using a hydraulic punch and punches sized for the conduit to be installed.
   2. Install a conduit breather in the top of the box and a conduit drain fitting in the bottom of all boxes.
   3. Support boxes for other than electrical outlets and devices using one of the following methods:
      a. Mount the boxes directly to the structure using 4 or more anchors.
         1) Attach mounting screws to feet located outside of the box interior or seal the screw holes to prevent water penetration.
         2) Provide 1/4-inch spacers behind the boxes unless the box has raised pads.
      b. Attach the box to two 1-inch or larger conduits which are supported within 12-inches of the box.
      c. Mount the box on U-channel and structural supports conforming to Section 16070 Hangars and Supports for Electrical Systems.

C. Make up all conduit connections to boxes in accordance with the requirements of Section 16130 Conduits for Electrical Systems.

D. Install wiring in boxes in accordance with the requirements of Section 16120 Low Voltage Electrical Power Conductors and Cables.

E. Ground boxes in conformance with Section 16060 Grounding and Bonding For Electrical Systems.

3.04 REPAIR/RESTORATION

A. Touch up damaged coatings on electrical boxes and enclosures.

3.05 FIELD QUALITY CONTROL

A. Site Tests:
   1. Test all boxes to verify that they are properly connected to the grounding system.

B. Inspection:
   1. Inspect flush boxes to verify that the opening between the box and the wall finish is less than 1/16-inch.
   2. Inspect flush boxes to verify that each box is flush with the wall, or protrudes less than 1/16-inch, and is not set behind the wall surface.
   3. Inspect surface mounted boxes to verify that they are level and plumb within 1/16-inch as specified.

3.06 CLEANING

A. Waste Management and Disposal:
   1. Clear and dispose of waste materials in accordance with the requirements of Section 16050 Common Work Results for Electrical.

3.07 PROTECTION

A. Except for surfaces to be painted, mask electrical boxes to protect them from paint overspray or over-brushing during painting operations.

B. Protect boxes against damage from other work.

END OF SECTION

SECTION 16145

WIRING DEVICES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Requirements for furnishing, installing, connecting, energizing, testing, cleaning, and protecting wiring devices and cover plates.

B. Related Sections:
   1. Refer to Procurement Documents.
   2. Section 16050 Common Work Results for Electrical
   3. Section 16060 Grounding and Bonding for Electrical Systems
   4. Section 16070 Hangers and Supports for Electrical Systems
   5. Section 16075 Identification for Electrical Systems
   6. Section 16080 Acceptance of Electrical Systems
   7. Section 16120 Low Voltage Electrical Power Conductors and Cables
   8. Section 16130 Conduits for Electrical Systems
   9. Section 16132 Boxes for Electrical Systems

1.02 REFERENCES

A. Reference Standards:
   1. U. S. Government:
      a. Federal Transit Administration (FTA):
         1) 49 CFR 661 Buy America Requirements

B. National Electric Manufacturer's Association (NEMA):
   1. NEMA WD 1 - General Color Requirements for Wiring Devices.
   2. NEMA WD 6 - Wiring Devices - Dimensional Requirements.

C. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC).

D. Underwriter’s Laboratories, Inc. (UL):
   1. UL 231 - Standard for Power Outlets.
   2. UL 498 - Standard for Safety for Attachment Plugs and Receptacles.
   3. UL 1681 - Standard for Safety for Wiring Device Configurations.

E. U. S. General Services Administration (GSA):
   1. Federal Specifications:

a. W-C-596/40D - Connector, Receptacle, Electrical, General Purpose, Duplex, General Grade and Hospital Grade, Grounding, 2 Pole, 3 Wire, 20 Amperes, 125 Volts, 50/60 Hertz, Box Mount and Snap-In Mount.
b. W-C-596/41D - Connector, Receptacle, Electrical, General Purpose, Single, Hospital Grade, Grounding, 2 Pole, 3 Wire, 20 Amperes, 125 Volts, 50/60 Hertz.
c. W-C-596/107A - Connectors, Receptacle, Electrical, Special Purpose, Single, Grounding, 2 Pole, 3 Wire, 20 Amperes, 277 Volts, 50/60 Hertz.

1.03 DEFINITIONS

A. Definitions for all items are as stated in NFPA 70 and the other references listed unless otherwise stated, specified, or noted.

B. SPDT: An acronym for single pole, double throw type electrical switches.

C. Wiring Devices: Yoke mounted switches and receptacles with indicated line ratings of 300 Volts and 30 Amperes or less.

1.04 DESIGN REQUIREMENTS

A. Provide electrical power outlets designed in accordance with the requirements of UL 231 and UL 1681.

B. Product Data:
1. Submit a list of the products and accessories proposed to satisfy the requirements of this Section.
2. Submit Product Data and catalog cuts of the materials and equipment proposed to be used to satisfy the requirements of this Section.
a. Clearly indicate the usage of each product on the submittal.

1.05 SUBMITTALS

A. Submit the following information to the Engineer for approval in accordance with the requirements of the Procurement Documents:
1. Product Data:
a. List of the proposed materials.
b. Catalog cuts of heavy duty specification grade receptacles.
c. Catalog cuts of device plates and covers.
2. Quality Assurance/Control Submittals:
a. Manufacturers Instructions.
1) Manufacturer's printed installation instructions.

1.06 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:

1. Buy America Act:
   a. Except for those products which are exempt under the specific statutory waivers stipulated in 49 CFR 661, all other products supplied under this Section must comply with the requirements of the Buy America Act.

B. Regulatory Requirements:
   1. Perform the Work of this Section in accordance with the requirements specified in NFPA 70, and to all other applicable state, local, and national governing codes and regulatory requirements.

C. Certifications:
   1. Provide products that are listed and labeled by Underwriters Laboratory, approved by Factory Mutual, or certified as meeting the standards of UL by the Electrical Testing Laboratory (ETL) for the location installed in, and the application intended, unless products meeting the requirements of these testing laboratories are not available or unless standards do not exist for the products. Provide copper conductors listed and labeled by UL for all wiring.
   2. Submit evidence of testing agency/quality verification, listing, and labeling for each product with the submitted product data either by providing a printed mark on the data or by attaching a separate listing card.

1.07 MATERIAL DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
   1. Pack, ship, handle, and unload products in accordance with the requirements of Section 16050.

B. Acceptance at Site:
   1. Accept products at the Site in accordance with the requirements of Section 16050.

C. Storage and Protection:
   1. Store products in accordance with the requirements of Section 16050.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Use of Trade Names:
   1. The use of trade names within the Contract Documents is intended to establish the basis of design and to illustrate the constructability and level of quality required.
   2. The use of trade names is not intended to exclude other manufacturers whose products are equivalent to those named, subject to compliance with Contract requirements.

B. Provide the receptacles of the same kind provided under this Contract from the same manufacturer; a mixture of manufacturer's products is unacceptable.

2.02 MANUFACTURED UNITS

A. NOT USED.

B. Receptacles:
   1. Provide UL listed specification grade receptacles complying with the requirements of W-C-596/40D, W-C-596/41D, W-C-596/107A, NEMA WD 1, and NEMA WD 6 for the voltage and current indicated, and having screw terminals.
      a. Provide receptacles complying with the terminal identification requirements of UL 498.
   2. Standard Face Design Receptacles:
      a. Heavy Duty Specification Grade Receptacles:
         1) Provide 2-pole, 3-wire, grounding type duplex receptacles rated for 125 Volts AC and 20 Amperes.
         2) Manufacturers:
            a) Hubbell, HBL5352 Series, www.hubbell-wiring.com.
            b) Pass & Seymour, www.passandseymour.com.
            c) Leviton Manufacturing Co., www.leviton.com.
            d) Or Approved equal.

2.03 ACCESSORIES

A. Wall Plates:
   1. Unless otherwise indicated in the Contract Documents, provide AISI Type 302/304 stainless steel wall plates.
      a. Provide heavy cadmium-plated steel wall plates whose edges are flush with the edges of the associated boxes.
      b. For locations subject to wet or rain conditions, provide wet location wall plates marked with the words "Suitable for Wet Locations While in Use".
   2. Thickness (Minimum): 0.040 inches thick (1mm).
   3. Fasteners:
      a. For installing wiring devices and wall plates, provide the following of fastener types:
         1) For affixing metal wall plates, provide stainless steel screws.
   4. Manufacturers:
      a. Hubbell, www.hubbell-wiring.com.
      b. Pass & Seymour, www.passandseymour.com.
      c. Appleton, www.appletonelec.com.
      d. Cooper Crouse-Hinds, http://crouse-hinds.com.
      e. Approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect the surfaces of concrete walls where wiring devices will be mounted to verify that the surface is level and complete.
   1. Verify that the required number of anchors of the correct type and size have been placed in the proper locations.
   2. Verify that there are no concrete spalls, honeycomb areas, or other concrete defects.

B. Verify that the pull and junction boxes installed are the correct type and size, and are at the correct location.
   1. Verify that flush boxes are plumb and level to within 1/8-inches of vertical and horizontal; and are either flush with the finish surface or protrude no more than 1/16 inch.
   2. Verify that surface mounted boxes are plumb and level to within 1/16-inch of vertical and horizontal.
   3. Verify that the size of each box conforms to the requirements of Article 370 of NFPA 70.

C. Verify that wiring pigtails within installed boxes are sufficiently long to re-terminate the wiring twice and still allow 6 inches of slack.

D. Verify that ground wires are the correct type and size, and are at the correct location.

3.02 PREPARATION

A. Correct defects discovered during the examination
   1. Remove any extraneous paint from the interior of boxes and from wiring.
   2. Clean the interior of boxes to remove dirt and debris.

B. Provide outlet boxes and supports for wiring devices in accordance with the requirements of Section 16070 and 16132.

3.03 INSTALLATION

A. Install wiring devices and accessories in accordance with the manufacturer's printed installation instructions.
   1. Submit the manufacturer's printed installation instructions to the Engineer for information.
   2. Make connections to the devices in accordance with the requirements of Sections 16120 and 16130.
   3. Ground the devices in accordance with the requirements of Section 16060.

B. Provide a wall plate for each receptacle and special purpose outlet.

1. If the Contract Drawings show two or more receptacles at the same location, gang these devices together and cover them with a single wall or cover plate.
2. For multi-gang boxes, provide multi-gang outlet plates; sectional gang plates are unacceptable.

3.04 REPAIR/RESTORATION

A. Correct the defects that are found in wiring devices during the specified inspections and tests, and retest the devices after correcting the defects.

3.05 FIELD QUALITY CONTROL

A. Site Tests:
   1. Test each receptacle with a plug-in tester that checks for reversed line and neutral wiring, reversed ground and neutral wiring, open ground wiring, and open neutral wiring.
   2. Test the last receptacle in each branch circuit to ensure that the neutral and ground wiring resistance does not exceed 1 ohm between the receptacle and its panelboard.

B. Inspection:
   1. Inspect boxes to verify proper operation, for visual appearance, and to verify correct mounting height.

3.06 ADJUSTING

A. Adjust the final position of switches and devices to be plumb and level, and set the final position of the wall plates for flush boxes flush to the wall.

3.07 CLEANING

A. Waste Management and Disposal:
   1. Clear and dispose of waste materials in accordance with the requirements of Section 16050.

3.08 PROTECTION

A. Mask electrical devices to protect them from paint overspray or over-brushing during painting operations.

B. Protect electrical devices against damage from other work.

END OF SECTION

SECTION 16525

LIGHTING FIXTURES AND MOUNTING POLES

PART 1 - GENERAL

1.01 DESCRIPTION:

A. This section specifies providing lighting fixtures and mounting poles.

B. Related Work Specified Elsewhere:
1. Grounding and bonding: Section 16060.
2. Identification for Electrical Systems: Section 16075.
3. Wireways for Electrical Systems: Section 16131.
4. Boxes for Electrical Systems: Section 16132.
5. Wiring Devices and control devices: Section 16145.

1.02 QUALITY ASSURANCE:

C. Codes, Regulations, Reference Standards and Specifications:
1. Comply with codes and regulations of jurisdictional authorities.
2. NEC.
3. UL: 496, 542, 1029, 1570, 1571, 1572, Electrical Construction Materials Directory.
4. FS: FF-B-588, FF-P-395, FF-S-325C.
5. MS: MIL-C-450.
6. FED STD: 595.
7. PEI: 1001.
8. SSPC: SP-8, SP-10.
9. ASTM: A53, A167, A276, A123, A507, A575, B26, B85, B117, B136, B137, B209, B221, B244, D635, D1056, D1400, D2240.
10. AASHTO: M314, LTS-3.
11. ITS: Directory of ITS Listed Products.
12. AA: Standard finishes as designated by the Aluminum Association and referenced in NAAMM Metal Finishes Manual.
13. ANSI/IEEE: C62.41.
14. IEEE Publication 587.
15. ANSI Standards.
16. FCC Rules and Regulations, Part 15, Part 18.
17. NEMA 1
18. AISI.
19. IES: RP-20

D. Each lighting fixture to be labeled or listed per referenced UL or ITS directory.

1.03 SUBMITTALS:

E. Submit the following for approval in accordance with the General Requirements and with the additional requirements as specified for each:
1. Shop Drawings:

a. Include photometric curves.
2. Samples: One of each type of fixture.
3. Certification:
a. Verification that each fixture is in compliance with applicable codes, regulations, reference standards and specifications for the location at which it is to be used. Indicate requirements that each fixture meets.
b. Calculations: Submit calculations by a professional engineer registered in the jurisdiction where material is to be installed certifying that assemblies of foundation, anchor bolts, pole, arms and luminaire will withstand specified wind pressure, wind speed, stress, deflection, vibration and fatigue.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING:

F. Ship each unit securely packaged and labeled for safe handling in shipment and to avoid damage or distortion.

G. Store lighting fixtures and mounting poles in secure and dry storage facility.

1.05 WARRANTY:

H. Globes and Diffusers: In addition to warranty requirements of the General Provisions, furnish warranty against discoloration and distortion for a total of four years.

I. Lamps: Warrant the life of lamps for periods specified.

PART 2 - PRODUCTS

2.01 PRODUCTS AND MATERIALS:

J. General Requirements for Lighting Fixtures:
1. Interchangeability: Components of same type, size, rating, functional characteristics and make are to be interchangeable.
2. In accordance with UL 1570, UL 1571 and UL 1572.
3. Materials:
a. Steel:
1) Sheet: ASTM A507, 22-gauge minimum.
2) Bar: ASTM A575.
b. Steel pipe: ASTM A53, Type S.
c. Stainless steel:
1) Sheet: ASTM A167, 22-gauge minimum.
2) Bar: ASTM A276, Type 316.
3) Finish: AISI Alloy S30400, NAAMM Finish No. 4, unless otherwise shown.
d. Aluminum: Alloy as recommended by manufacturer, unless otherwise shown or specified.
1) Sheet and plate: ASTM B209.

2) Extrusion: ASTM B221, 0.109-inch minimum thickness, unless otherwise shown.
3) Cast:
a) Die cast: ASTM B85, 0.1875-inch minimum thickness, unless otherwise shown.
b) Sand cast: ASTM B26, 0.1875-inch minimum thickness, unless otherwise shown.
c) Color-anodized cast: Kalcolor Casting Alloy No. 2 or equal.

4. Lamps:
a. Mercury vapor:
1) Watt rating: As shown.
2) Color: Deluxe white.
3) Finish: As shown.
4) Base:
a) Up to 100 watts: Medium screw base.
b) Above 100 watts: Mogul screw base.
5) Rated life: 24,000 hours.
6) Bulb size: As shown.
b. Fluorescent:
1) Wattage and size: As shown or specified.
2) Color: Warm white.
3) Type:
a) PL7 compact, PL13 compact.
b) F6T5/CW and F20T12WW, Preheat start.
c) F32T8/WW, F48T12/WW/SHO, F72T12/WW/SHO, and F96T12/WW/SHO: Rapid start.
4) Rated life:
a) Super-high output (SHO), very-high output (VHO) and high output (HO) lamps: 12,000 hours.
b) F32T8/WW: 20,000 hours.
c) PL compact lamps: 10,000 hours.
5) Base:
a) Super-high output (SHO), very-high output (VHO) and high output (HO) lamps: Recessed double contact.
b) F32T8/WW: Medium bi-pin.
c) PL7 medium.
c. Tungsten-halogen:
1) Wattage: As shown.
2) Size: T-3.
3) Base: Recessed single contact.
4) Rated life: 4,000 hrs.
5) Operating voltage:
a) 1,500-watt lamps: 277 volts, 60 Hertz.
b) All other lamps: 120 volts, 60 Hertz.
d. Metal-halide:
1) Wattage: As shown.
2) Size: As shown.

3) Color: Clear unless otherwise noted.
4) Lamp operating position: As shown.
5) Base: Mogul.
6) Rated life:
a) 175 watt: 7,500 hours.
b) 400 watt: 15,000 hours.
c) 1,000 watt: 10,000 hours.

e. High-pressure sodium:
1) Wattage: As shown.
2) Size: As shown.
3) Coating: Clear, unless otherwise shown or specified.
4) Base: Medium or mogul.
5) Rated life: 24,000 hours.

5. Lampholders:
a. Mercury vapor, metal halide and high-pressure sodium:
1) In accordance with UL 496.
2) Black or white thermosetting phenolic compound, glazed-porcelain or neoprene base and body as shown. Neoprene unit molded in one-piece, weatherproof, oil-resistant, with vibration-absorbing socket construction.
3) Mercury vapor, high-pressure sodium and metal halide:
a) Rated 660 watts, 600 volts: Medium screw base.
b) Rated 1,500 watts, 600 volts: Mogul screw base.
4) Provide mechanical self-retaining neoprene gasket for dust and moisture proof seal between lamp and lampholder.
5) Provide vibration proof feature to prevent incandescent lamp from loosening in lampholder in S-1 fixture

b. Fluorescent:
1) In accordance with UL 542.
2) Rated 660 watts, 600 volts.
3) Integral starter holder for preheat-type lamps, with starter.
4) White, thermosetting phenolic-compound base and body, silver-plated phosphorous-bronze contacts, self-aligning neoprene gasket face.

c. Tungsten-halogen: Porcelain with silver-plated contacts, to suit RSC lamp base.

6. Ballasts:
a. Mercury-vapor lamps, high-pressure sodium lamps and metal-halide lamps:
1) UL 1029, high-power-factor type.
2) Operable on 120-volt or 277-volt, 60 Hertz as shown or necessary, type and rating suitable for associated lamp.
3) Capable of starting lamp at ambient temperature of minus 20F and above.
4) Equip with individual fuse protection installed in ballast compartment of fixture.

b. Fluorescent lamps:
1) FCC part 15 subpart J, UL listed Class P.

2) Operable on 120-volt or 277-volt, 60 Hertz, as shown or necessary, type and load rating suitable for associated lamps.
3) Capable of starting lamps at ambient temperature as follows:
   a) F32T8/WW lamps: Zero degree F.
   b) F48T12/WW/SHO, F72T12/WW/SHO, and F96T12/WW/SHO lamps: Minus 20F.
4) Sound rating:
   a) For use with F32T8/WW lamps installed in office areas: A.
   b) For use with F32T8/WW lamps installed in ancillary areas: B or better.
   c) For use with F48T12/WW/SHO, F72T12/WW/SHO, and F96T12/WW/SHO lamps: D or better.
5) Maximum utilization of two-lamp ballasts in public-area lighting fixtures.
6) Equipped with individual fuse protection, installed in the fixture wiring channel.

7. Fixture body and housing: Shape, size and material as shown.
8. Reflector: Shape, size and material as shown. Aluminum or stainless steel polished to mirror finish unless otherwise shown. Minimum thickness 22 gauge unless otherwise shown.
9. Diffusers:
   a. Shape and size as shown, one-piece molded or extruded clear virgin acrylic or polycarbonate plastic having the following properties:
      1) Interior diffusing with smooth exterior surface.
      2) Self-extinguishing, in accordance with ASTM D635.
      3) No material color change when used with 4500K fluorescent lamp.
      4) No apparent yellowing after 500 hours exposure to fluorescent-lamp source under conditions similar to those existing in the lighting fixture.
      5) No alteration to optical properties of the fixture when finished diffuser treated with anti-static wax.
   b. Formed by carefully controlled processes so that the finished piece retains its design contours and dimensions at normal operating temperature.
   c. Resistance to shrinking, warping, crazing, cracking, or discoloring, either in service or when stored in the manufacturer's standard shipping containers under normal conditions.
10. Globes:
   a. Clear seamless polycarbonate or high-impact heat-resistant glass as shown.
   b. Shape and size: As shown.
   c. Minimum thickness: 0.125 inch, surface free from visible mold seam.
   d. Reduction in strength: 10-percent maximum after five years.
   e. Maximum haze: Two percent.
   f. Minimum light transmittance: 88 percent.
11. Lenses:
   a. Plastic lenses: Clear polycarbonate as shown, minimum thickness 0.06 inch.

b. Glass lenses: 1/4-inch tempered glass, laminated glass, or 1/8-inch double-strength clear glass as shown, capable of absorbing ultraviolet rays when used with mercury-vapor or metal-halide lamps.

c. Refracted lenses: Heat-resistant, annealed, clear borosilicate glass, with the following additional requirements:

1) Initial lumen distribution on horizontal plane evenly from zero to 90 degrees: 55 to 60 percent.

2) Minimum efficiency: 85 percent.

12. Fixture wire: Section 16120.

13. Gasket:

a. Keyed gasket: One-piece, extruded solid neoprene having Type A durometer hardness of 30 plus-or-minus five when tested in accordance with ASTM D2240.

b. Self-retaining gasket:

1) One-piece, closed-cell sponge neoprene, soft or medium density.

2) Resistant to aging, heat, ultra-violet light, water, oil, weathering and setting as determined by ASTM D1056.

3) Cemented to component with resilient neoprene sealing compound compatible with finish. Adhesive not applied to diffuser.

c. Silicone gasket equal to neoprene, at Contractor's option.

14. Hardware:

a. Latches, catches, release mechanisms, hinges, screws, bolts, studs, nuts, rivets, washers and springs. Heavy-duty stainless steel or bronze, as shown.

b. Latches and catches: Captive-type.

c. Operating hardware: Self-retaining type.

15. Construction:

a. Fixture body, reflectors, wiring channels, end caps and castings formed so as to prevent buckling or distortion.

b. Minimum of two wire clips provided in wiring channel to support wiring. Self-cleaning air filter provided on breather ports.

c. Seams and joints continuously welded and ground smooth.

d. When aluminum will be in contact with dissimilar metal, separate contact surfaces with gasket, non-absorptive tape, or coating to prevent corrosion.

16. Finish:

a. Baked enamel: Nonspecular finish consisting of six-stage hot-cleaning wash, phosphate coat, prime coat, and finish coat of sprayed white or other color acrylic enamel as shown, baked at 350F for a minimum of 30 minutes, with the following additional requirements:

1) Dry-film thickness (DFT) per ASTM D1400: 1.25 mils minimum.

2) Undercutting of enamel film from scored line after exposing to 10-percent salt spray for 1,500 hours, per ASTM B117: 0.067-inch maximum.

3) Baked white enamel after 100 hours exposure to fadeometer: 86-percent minimum reflectance factors, no appreciable visual color change.

4) Bronze color: FED STD 595, Color No. 20040.

b. Porcelain enamel: Opaque, fused vitreous surface finish, 88-percent average reflectance factor, in accordance with the following standards:
   1) On steel: PEI 1001.
   2) On aluminum alloy: PEI 1001.
c. Specular anodized coating: 14-stage process for permanently sealed specular or semispecular finish, as shown, in accordance with patented electrolytic process, Alzak or equal. When shown dark-bronze color, match Duranodic 313 Dark Bronze.
d. Clear anodic coating: AA-M22C22-A41, minimum coating thickness 0.8 mil, coating weight 35 milligrams per square inch, hot-water seal overall, tested in accordance with the following requirements:
   1) Coating weight: ASTM B137.
   2) Coating thickness: ASTM B244.
   3) Sealing test: ASTM B136.
   4) Undercutting of anodic film from scored line after exposing to 10-percent salt spray for 1,500 hours, in accordance with ASTM B117: 0.067-inch maximum.
e. Color-anodized finish: NAAMM AA-M22-C22A42, minimum coating thickness 0.8 mil, coating weight 35 milligrams per square inch, hot-water seal overall, tested in accordance with the following requirements:
   1) Coating weight: ASTM B137.
   2) Coating thickness: ASTM B244.
   3) Sealing test: ASTM B136.
   4) Color: Dark Bronze. Kaiser Aluminum Color, Statuary Bronze; Alcoa Color, Dark Bronze, Duranodic 313.
f. Zinc coating: ASTM A123.
g. Factory-painting: Prepare surfaces by pickling in accordance with SSPC SP-8. Apply coating of 7.0-mil total DFT as follows:
   1) First coat: Inorganic zinc-silicate primer, 2.5-mil DFT.
   2) Second coat: High-build epoxy primer, 3.0-mil DFT.
   3) Third coat: Aliphatic polyurethane, 1.5-mil DFT, FED STD 595, Color No. 20040.
h. Field painting: Section 09900.
i. Electrostatic-powder coating: Prepare surfaces by sandblast cleaning complying with SSPC SP-10 near-white blast cleaning, applying coating promptly after cleaning. Ground material to be coated. Apply coating as electrostatically-charged dry powder using electrostatic spray gun to produce DFT of six mils plus-or-minus two mils. Cure by heat treatment.

17. Mark each fixture and its components in accordance with applicable reference standard.
18. Conduit: Section 16130.
19. Connectors: Section 16050.
20. Fasteners: Size and type shown or best suited to use.
    a. Expansion anchors: FS FF-S-325C, Group II, Type 3, Class 1, stainless steel, Type 303.
    b. Toggle bolts: FS FF-B-588.
    c. Powder-actuated: FS FF-P-395.

d. Finish: Where exposed, custom finish exposed parts to match surface being fastened.

21. Anchor bolts, nuts and washers:
    a. AASHTO M314, hot-dip galvanized.
    b. Bolts hooked, unless otherwise shown or recommended by manufacturer of pole or structure being anchored.
    c. Two nuts and one washer for each anchor bolt for plumbing pole or leveling structure.
    d. Finish: Where exposed, custom finish exposed parts to match surface being fastened.
22. Mounting poles:
    a. Steel or aluminum, straight or tapered as shown. Complete assembly of anchor bolts, pole, arms and luminaire designed to withstand wind pressure (P) developed by wind speed (V) of 80 MPH in accordance with AASHTO LTS-3. Pole assembly to fully comply with AASHTO requirements for permissible stresses, deflection, vibration and fatigue. Ratio of deflection to pole height under action of applicable static loading not to exceed 1/60.*i

    OR

    b. Steel, straight or tapered as shown. Complete assembly of anchor bolts, pole, arms and luminaire designed to withstand wind pressure (P) developed by wind speed (V) of 80 MPH in accordance with AASHTO LTS-3. Pole assembly to fully comply with AASHTO requirements for permissible stresses, deflection, vibration and fatigue. Ratio of deflection to pole height under action of applicable static loading not to exceed 1/60.*ii
    c. Size and shape: As shown.
    d. Base assembly: Steel base plate, designed to withstand full-bending movement of shaft and welded to shaft; anchor bolts; and base cover.
    e. Handhole size: As shown, with 12-gauge steel sheet coverplate.
    f. Polygonal-shaped poles fabricated with sharp bends.
    g. Longitudinally welded with welds continuous and ground smooth.
23. Grout: Section 03300, nonshrink. Where recommended by manufacturer, prime surfaces to be grouted.
24. Concrete base, including forms and reinforcement: Division 3..
25. Bituminous coating: MS MIL-C-450.

2.02 LIGHTING FIXTURES:

K. Parking Structure Lighting Fixtures: The low glare fixture shall comply with the latest IES Specifications, RP-20 (Lighting for Parking Facilities).The electrical components will carry a five year minimum warranty, with other components covered by a two (2) year warranty.
1. Housing: A die cast housing integrating the high power factor ballast and wiring splices. The wiring shall be rated for 90°C.
2. Ballast: High power factor with multitap power feature 120/277V, 60HZ. UL listed and capable for starting at -20°F
3. Lamp: 150 W, High Pressure Sodium, Medium base, clear. Average life of 24,000 hours.
4. Fixture shall be fused, totally sealed and UL listed for wet location.

L. Other Lighting Fixtures: Types as shown, with materials and finishes shown and specified

PART 3 - EXECUTION

3.01 INSTALLATION:

M. Install lighting fixtures of types shown at locations shown as follows:
1. Mount fixtures rigidly in place. Use expansion anchors and machine screws for concrete surfaces and toggle bolts for hollow concrete-masonry surfaces. Use appropriate fasteners for attachment to other surfaces. Support lighting fixtures independent of suspended acoustical-panel ceiling systems.
2. Where aluminum contacts concrete or dissimilar metal, separate contact surfaces with gasket, non-absorptive tape or bituminous coating to prevent corrosion. Use stainless-steel fasteners.
3. Mount fixtures plumb, level and in straight lines. Install stems of suspended fixtures plumb. Group-mounted fluorescent fixtures to appear as one unit.
4. Install 12-inch minimum length of liquid-tight flexible conduit for connection between fixture and outlet box unless otherwise shown in accordance with Section 16130. Use fixture wire from outlet box in branch circuit to lighting fixture in accordance with Section 16525, and connect fixtures to branch circuit in accordance with Section 16145.
5. Install chase nipple where fluorescent fixtures are installed in continuous groups. Clean lamps, diffusers, globes, reflectors and exposed-to-view surfaces of fixtures after aiming and adjusting has been approved.

N. Installation of Pole-Mounted Fixtures:
1. Prepare and compact that earth foundation for mounting in accordance with Division 3. Form and reinforce concrete base as shown and in accordance with Section 03010. Mix and place concrete in accordance with Section 03010. Use finish Number 2 for exposed surfaces. Use templates for setting anchor bolts.
2. Install mounting pole of type shown at location shown. Use double nuts to erect poles plumb. Pack void between concrete base and pole with grout in accordance with Section 03010.
3. Install conductors in accordance with Section 16120, leaving three-foot minimum lengths of conductors for fixture connections; tape or otherwise secure in place pending final connection.
4. Install lighting fixtures in accordance with approved shop drawings.
5. Connect wiring using connectors in accordance with Section 16050. Tape connections.
6. Install photoelectric controls as shown or in accordance with fixture manufacturer's instructions.
7. Ground lighting fixtures and mounting poles in accordance with NEC and Section 16060.
8. Apply touch-up paint where necessary in accordance with Section 09900.

3.02 FIELD QUALITY CONTROL:

O. Ensure that earth foundation for mounting poles is prepared and compacted.

P. Testing:
1. Furnish necessary personnel and equipment and perform tests and adjustments in the presence of the Engineer. Schedule adjustment of exterior installations to occur during hours of darkness.
2. Test lighting circuits for continuity and operation.
3. Test fixtures and mounting poles for continuity of grounding system.
4. Aim and adjust fixtures to provide distribution pattern approximately as shown and as approved.

SEE END NOTES BELOW. THEY ARE AN ESSENTIAL PART OF THIS SECTION UNTIL EDITED BY DESIGNER.

ENDNOTES:

***i**. Use first version of 2.1 A.22.a. Modification for all contracts requiring lighting fixture mounting poles for S&I yards.

***ii**. Use second version of 2.1 A.22.a. Modification for all contracts requiring lighting fixture mounting poles at locations other than S&I yards.

END OF SECTION