

PROJECT MANUAL

Santa Barbara Metropolitan Transit District Terminal 2 Recommissioning

5353 Overpass Road
Goleta, CA 93111

PREPARED BY:

Stantec Architecture Inc.
801 S. Figueroa St, Suite 300
Los Angeles, CA 90017

Stantec Project No.:
2014240805

TABLE OF CONTENTS

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

See Solicitation Instructions
See Solicitation Instructions, Attachment 1: Bid Forms & Certifications
See Solicitation Instructions, Attachment 4: MTD Master Agreement
See Solicitation Instructions, Attachment 5: FTA Contract Provisions
See Solicitation Instructions, Attachment 6: CA Contract Provisions for Public Works

DIVISION 01 - GENERAL REQUIREMENTS

01 10 00 - SUMMARY
01 23 00 - ALTERNATES
01 25 00 - SUBSTITUTION PROCEDURES
01 26 00 - CONTRACT MODIFICATION PROCEDURES
01 31 00 - PROJECT MANAGEMENT AND COORDINATION
01 31 50 - PROJECT MANAGEMENT CONTROLS SYSTEM
01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION
01 32 33 - PHOTOGRAPHIC DOCUMENTATION
01 33 00 - SUBMITTAL PROCEDURES
01 40 00 - QUALITY REQUIREMENTS
01 42 00 - REFERENCES
01 43 39 - MOCKUPS
01 50 00 - TEMPORARY FACILITIES AND CONTROLS
01 56 39 - TEMPORARY TREE AND PLANT PROTECTION
01 60 00 - PRODUCT REQUIREMENTS
01 60 01 - BUY AMERICA REQUIREMENTS
01 73 00 - EXECUTION
01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
01 77 00 - CLOSEOUT PROCEDURES
01 78 23 - OPERATION AND MAINTENANCE DATA
01 78 39 - PROJECT RECORD DOCUMENTS
01 79 00 - DEMONSTRATION AND TRAINING

DIVISION 02 - EXISTING CONDITIONS

02 41 19 - SELECTIVE DEMOLITION
02 82 00 - REGULATED AND HAZARDOUS MATERIALS

DIVISION 03 - CONCRETE

REFER TO STRUCTURAL DRAWINGS FOR CONCRETE SPECIFICATIONS

DIVISION 05 - METALS

05 50 00 - METAL FABRICATIONS
05 53 13 - BAR GRATINGS

REFER TO STRUCTURAL DRAWINGS FOR ADDITIONAL METALS SPECIFICATIONS

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

06 10 53 - MISCELLANEOUS ROUGH CARPENTRY
06 41 69 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 16 16 - CRYSTALLINE WATERPROOFING
07 54 23 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING
07 62 00 - SHEET METAL FLASHING AND TRIM
07 92 00 - JOINT SEALANTS

DIVISION 08 - OPENINGS

08 71 00 - DOOR HARDWARE

DIVISION 09 - FINISHES

09 51 23 - ACOUSTICAL TILE CEILINGS
09 65 13 - RESILIENT BASE AND ACCESSORIES
09 65 19 - RESILIENT TILE FLOORING
09 67 23.37 - HEAVY DUTY RESINOUS FLOORING
09 90 00 - PAINTING
09 96 56.13 - EPOXY COATINGS FOR WASH BAY WALLS

DIVISION 10 - SPECIALTIES

10 14 23 - PANEL SIGNAGE
10 41 16.13 - FIRE DEPARTMENT KEYED ACCESS CONTROL SPECIALTIES

DIVISION 11 - EQUIPMENT

11 11 26 – VEHICLE WASHING EQUIPMENT

DIVISION 12 - FURNISHINGS

12 24 13 - ROLLER WINDOW SHADES

DIVISION 14 - CONVEYING EQUIPMENT

NOT APPLICABLE

DIVISION 21 - FIRE SUPPRESSION

NOT APPLICABLE

DIVISION 22 - PLUMBING

REFER TO PLUMBING DRAWINGS FOR PLUMBING SPECIFICATIONS

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

23 12 17 - DIESEL FUEL DISPENSING SYSTEM

23 13 23 - ABOVE-GROUND FUEL STORAGE TANK SYSTEM

REFER TO MECHANICAL DRAWINGS FOR HVAC SPECIFICATIONS

DIVISION 26 - ELECTRICAL

REFER TO ELECTRICAL DRAWINGS FOR PLUMBING SPECIFICATIONS

DIVISION 27 - COMMUNICATIONS

27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

27 05 28 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

27 05 43 - UNDERGROUND DUCTS AND UTILITY STRUCTURES FOR
COMMUNICATION SYSTEMS

27 11 00 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

27 13 00 - COMMUNICATIONS BACKBONE CABLING

27 15 00 - COMMUNICATIONS HORIZONTAL CABLING

27 51 13 - PAGING SYSTEMS

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY & SECURITY

28 23 00 - VIDEO SURVEILLANCE

28 34 01 - FUEL LEAK-MONITORING SYSTEM

DIVISION 31 - EARTHWORK

REFER TO CIVIL DRAWINGS FOR EARTHWORK SPECIFICATIONS

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 32 17 23 - PAVEMENT MARKINGS

SECTION 32 17 26 - TACTILE WARNING SURFACING

SECTION 32 31 19 - DECORATIVE METAL FENCES AND GATES

REFER TO CIVIL AND LANDSCAPE DRAWINGS FOR ADDITIONAL EXTERIOR
IMPROVEMENT SPECIFICATIONS

DIVISION 33 - UTILITIES

REFER TO CIVIL DRAWINGS FOR UTILITY SPECIFICATIONS

APPENDICES

APPENDIX A – ASBESTOS & LEAD SURVEY REPORT

APPENDIX B – OF/CI SERVICE BOOTH INFORMATION

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including FTA Contract Provisions, MTD Master Agreement, and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:

- 1. Project information.
- 2. Work covered by Contract Documents.
- 3. Owner-furnished products.
- 4. Access to site.
- 5. Work restrictions.
- 6. Specification and drawing conventions.

- B. Related Requirements:

- 1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.03 PROJECT INFORMATION

- A. Project Identification: Santa Barbara Metropolitan Transit District (MTD) Terminal 2 Recommissioning Project.

- 1. Project Location: 5353 Overpass Road, Goleta, CA 93111.

- B. Owner: Santa Barbara Metropolitan Transit District (MTD).

- 1. Owner's Representative: Mr. David Rzepinski, Project Manager, 310-692-0274, drzepinski@sbmtd.gov.

- C. Architect: Stantec Architecture, Inc., 801 S. Figueroa Street, Suite 300, Los Angeles, CA 90017.

- 1. Contact: William Todd, AIA, 323-387-8919, will.todd@stantec.com.

- D. Construction Manager: Kitchell CEM, 1304 Broad Street, San Luis Obispo, CA 93401.

- 1. Contact: Shane Mahan, CCM, 805-689-1423, smahan@kitchell.com

2. Reference to Construction Manager in Project documents refers to the Construction Manager.
3. Construction Manager has been engaged for this Project to serve as an advisor to Owner and to provide assistance in administering the Contract for Construction between Owner and Contractor, according to a separate contract between Owner and Construction Manager.

1.04 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of, but is not limited to the following:
 1. Offsite work includes the addition of a new public sidewalk along Overpass Rd., new driveway curb-cuts, and adjacent landscaping.
 2. Sitework includes:
 - a. Demolition of existing, damaged site wall and landscaping around the perimeter of the facility.
 - b. New perimeter security fencing and vehicles gates, along with the addition of new pedestrian gates.
 - c. Replacement of existing site lighting.
 - d. Addition of new van accessible parking space.
 - e. Re-striping of all parking spaces.
 - f. Installation of OF/CI bollards and Service Attendant Booth.
 3. Refurbishment of existing Bus Wash Building. Including replacement of wash equipment, roof structure and membrane, concrete slab-on-grade, drainage, and lighting.
 - a. Refer to specification Section 01 23 00 "Alternates" for wash equipment bid alternate.
 4. Upgrades to the existing parking canopies is limited to the replacement of light fixtures, addition of new security cameras, and the addition of a new public address system.
 5. Installation of a new above ground 12,000 gallon diesel fuel tank with dispenser, including a concrete pad foundation, bollards, and electrical connection.
 6. Installation of a new steel framed canopy adjacent to the fuel tank for a new OF/OI fare collection vault.
 7. Maintenance repairs to the existing Office / Maintenance Building include:
 - a. Repair of gypsum board ceiling and new countertop with kitchen sink in the breakroom.
 - b. Replacement of plumbing fixtures in the office area restrooms and the conversion of these restrooms into single-occupancy restrooms.
 - c. Replacement of light fixtures in the maintenance bays.
 - d. Repainting of the interior and exterior of the building.
 - e. Replacement of the rooftop mechanical unit.

8. Abatement of lead paint and asbestos materials in areas impacted by other work. Refer to specification Section 02 82 00 "Regulated and Hazardous Materials".

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.05 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Work includes handling, protecting, and installing Owner-furnished products.
1. Post-installed bollards: Bollards are fabricated and on-site. Contractor is to install bollards where indicated on Drawings, concrete-fill, and paint per the Project Drawings.
 2. Service Attendant Booth: Booth is on-site and is to be installed where indicated on the Drawings and to have new electrical connection as indicated. Shop drawings for booth are provided in Appendix B of the Project Manual.

1.06 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project. Construction Manager will utilize Project Site space for ongoing coordination and management of Project. Contractor. Project site does not have telecommunications or internet access. Contractor will provide internet access throughout Project duration to be made available to Construction Manager.
- B. Security: Contractor will provide web-based camera system for surveillance of site. The camera system shall be accessible to all parties during the construction period, including Owner, Contractor, Construction Manager, and Architect and will integrate with the Project Website (Procore) hosted by the Construction Manager.

1.07 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 4:30 p.m., Monday through Friday, unless otherwise indicated or restricted by the City of Goleta.
1. Weekend Hours: Subject to coordination with Construction Manager for Project site access and subject to City noise ordinance limitations.

2. Early Morning Hours: To be compliant with City's noise ordinance limitations as applicable to the work.
 3. Hours for Core Drilling, Pavement Cutting, or other similarly loud activities: During normal work hours.
- C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption.
1. Notify Construction Manager not less than five days in advance of proposed disruptive operations.
 2. Obtain Construction Manager's written permission before proceeding with disruptive operations.
- D. Nonsmoking Property: Smoking is not permitted within the Project site or within 25 feet of entrances, operable windows, or outdoor-air intakes.
- E. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.08 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including FTA Contract Provisions, MTD Master Agreement, and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.03 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.04 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.

- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: Vehicle Wash Equipment.
1. Base Bid: All Project work associated with the Vehicle Wash, including the Vehicle Washing Equipment as specified in the Issue For Bid Drawings and Section 11 11 26 referring to the "Vehicle Wash Equipment."
 2. Deduct Alternate: All Vehicle Wash Project work, with the exception of Vehicle Wash Equipment. The alternate shall **exclude** the cost of the work associated with and the wash equipment as indicated on the Issue For Bid Drawings (Q-121, P202, E-301). The other work in the Project to rehabilitate the Wash Building, including but not limited to the structural improvements (roof, slab-on-grade, etc.), architectural (repainting, new roof, etc.), new plumbing (utility connection, trench drain, sump pit, etc.), and new electrical connection including the new electrical panel are to be included in the alternate.

END OF SECTION 01 23 00

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including FTA Contract Provisions, MTD Master Agreement, and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.03 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.04 ACTION SUBMITTALS

- A. Substitution Requests: Submit each request for consideration into Construction Manager hosted Project Website. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use CSI Form 13.1A.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

- b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Certificates and qualification data, where applicable or requested.
 - f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - g. Cost information, including a proposal of change, if any, in the Contract Price.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Owner's Representative of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.05 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.06 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
- a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
- a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.

- e. Requested substitution will not adversely affect Contractor's construction schedule.
- f. Requested substitution has received necessary approvals of authorities having jurisdiction.
- g. Requested substitution is compatible with other portions of the Work.
- h. Requested substitution has been coordinated with other portions of the Work.
- i. Requested substitution provides specified warranty.
- j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including FTA Contract Provisions, Master Agreement, and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 01 25 00 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.03 MINOR CHANGES IN THE WORK

- A. Architect with issue through Construction Manager supplemental instructions authorizing minor changes in the Work,

1.04 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Construction Manager will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Construction Manager are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within 10 business days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.

- d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail," or form mutually acceptable to the Contractor and Construction Manager.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Construction Manager.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include costs of labor and supervision directly attributable to the change.
 - 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - 6. Comply with requirements in Section 01 25 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
 - 7. Proposal Request Form: Use form acceptable to Construction Manager and Owner's Representative.

1.05 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Construction Manager will issue a Change Order for signatures of Owner and Contractor on AIA Document G701 or form mutually acceptable to the Contractor and Construction Manager.

1.06 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Construction Manager may issue a Construction Change Directive. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract into Project website.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including FTA Contract Provisions, MTD Master Agreement, and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Requests for Information (RFIs).
 - 3. Project meetings.
- B. Related Requirements:
 - 1. Section 01 31 50 "Project Management Controls System"
 - 2. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 3. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 4. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.

1.03 DEFINITIONS

- A. RFI: Request from Owner, Construction Manager, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.04 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1.05 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's construction schedule.
 - 2. Preparation of the schedule of values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Preinstallation conferences.
 - 7. Project closeout activities.
 - 8. Startup and adjustment of systems.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.06 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect and Construction Manager.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect or Construction Manager after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.

- d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
- 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
- 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Construction Manager in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly into Project website. Include the following:
 - 1. Project name.
 - 2. Name and address of Contractor.
 - 3. Name and address of Architect and Construction Manager.
 - 4. RFI number including RFIs that were returned without action or withdrawn.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Architect's and Construction Manager's response was received.
- F. On receipt of Architect's and Construction Manager's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager within seven days if Contractor disagrees with response.
 - 1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 - 2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.07 PROJECT MEETINGS

- A. General: Construction Manager will schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Construction Manager, and Architect, within three days of the meeting.
- B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Lines of communications.
 - f. Procedures for processing field decisions and Change Orders.
 - g. Procedures for RFIs.
 - h. Procedures for testing and inspecting.
 - i. Procedures for processing Applications for Payment.
 - j. Distribution of the Contract Documents.
 - k. Submittal procedures.
 - l. Use of the premises and existing building.
 - m. Work restrictions.
 - n. Working hours.
 - o. Owner's occupancy requirements.
 - p. Responsibility for temporary facilities and controls.
 - q. Procedures for disruptions and shutdowns.
 - r. Construction waste management and recycling.
 - s. Parking availability.
 - t. Office, work, and storage areas.
 - u. Equipment deliveries and priorities.
 - v. First aid.
 - w. Security.
 - x. Progress cleaning.
 4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, Construction Manager of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Possible conflicts.
 - i. Time schedules.
 - j. Manufacturer's written instructions.
 - k. Acceptability of substrates.
 - l. Temporary facilities and controls.
 - m. Space and access limitations.
 - n. Testing and inspecting requirements.
 - o. Installation procedures.
 - p. Coordination with other work.
 - q. Protection of adjacent work.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Construction Manager will schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 15 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.

- c. Submittal of written warranties.
 - d. Requirements for preparing operations and maintenance data.
 - e. Requirements for delivery of material samples, attic stock, and spare parts.
 - f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - i. Responsibility for removing temporary facilities and controls.
- 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Construction Manager will conduct progress meetings at weekly intervals.
 - 1. Coordinate dates of meetings with preparation of payment requests.
 - 2. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Site utilization.
 - 6) Temporary facilities and controls.
 - 7) Status of RFIs.
 - 8) Status of proposal requests.
 - 9) Pending changes.
 - 10) Status of Change Orders.
 - 11) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- F. Coordination Meetings: Construction Manager will conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
 1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c. Review present and future needs of each contractor present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Deliveries.
 - 4) Access.
 - 5) Site utilization.
 - 6) Temporary facilities and controls.
 3. Reporting: Record meeting results and distribute through Project Website to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 31 50 - PROJECT MANAGEMENT CONTROLS SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

- A. The MTD Construction Management representative firm (Kitchell CEM) will host the Project Website for the purposes of hosting and managing project communication and documentation until Final Completion. Project Website shall include the functions identified in Section 1.2 below. Project Website will be Procore. Contractor will access the site through a standard web-based interface (Internet Explorer) from any computer.
- B. Related Requirements:
 - 1. Section 01 25 00 – Contract Modification Procedures
 - 2. Section 01 26 00 – Request for Interpretation
 - 3. Section 01 31 00 – Project Management and Coordination
 - 4. Section 01 33 00 – Submittal Procedures
 - 5. Section 01 40 00 – Quality Requirements

1.02 INTRODUCTION

- C. This Section defines the administrative and procedural requirements for documenting the progress of construction during performance of the Work through use of the Project Website. At a minimum, for the following functions and procedures shall utilize the Project Website:
 - 1. Project Directory
 - 2. Request for Interpretation / Information (RFI)
 - 3. Submittals
 - a. Submittal Register
 - b. Submittal Packages
 - 4. Meeting Minutes
 - 5. Daily Construction Reports
 - a. Daily Details
 - b. Daily Work
 - 6. Document Management
 - 7. Outstanding Items List
 - 8. Punch list
 - 9. Inspection Requests
 - 10. Cost Control
 - a. Potential Change Orders
 - b. Change Order Requests

c. Executed Change Orders

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

The MTD Construction Management representative will coordinate with the Contractor and the Owner to utilize the Project Website's established standard, centralized, web-based Documents/Cost control system to record, scan, attach, track and manage transmittals, correspondence, requests for information (RFIs), submittals, daily reports, meeting minutes, punch lists, drawings, notices, potential change orders, change order requests, change orders, and other documents/tracking as required by this specification section

Two (2) sessions of system access and training will be provided to the Contractor at no charge. The Contractor shall have in attendance at either or both sessions all document coordinator(s), project engineers, superintendents, managers, and any other personnel desired by the Contractor to utilize the Project Website. Additional trainings can be performed at the request of, and cost to, the Contractor.

END OF SECTION

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including FTA Contract Provisions, MTD Master Agreement, and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's construction schedule.
 - 2. Construction schedule updating reports.
- B. Related Requirements:
 - 1. Section 01 33 00 "Submittal Procedures" for submitting schedules and reports.
 - 2. Section 01 40 00 "Quality Requirements" for submitting a schedule of tests and inspections.

1.03 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Owner, Construction Manager, and Architect.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.04 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals into Construction Manager hosted Project Website in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file.

1.05 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.01 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Performance shall commence within (14) calendar days of the date of the notice to proceed and achieve substantial completion within three hundred and eight (308) calendar days from the notice to proceed.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Construction Manager.
 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - a. Automatic vehicle gates and fencing.
 - b. Diesel fuel tank.
 - c. Bus Wash Equipment.
 - d. New rooftop mechanical equipment.
 3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 4. Startup and Testing Time: Include no fewer than 10 days for startup and testing.
 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
 2. Work under More Than One Contract: Include a separate activity for each contract.
 3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 5. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Use of premises restrictions.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
1. See Section 8 of Contract Master Agreement for cost reporting and payment procedures.

- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and Contract Time.
- G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.
1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Construction Manager and Architect's approval of the schedule.
 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

- a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing.
 - j. Punch list and final completion.
 - k. Activities occurring following final completion.
 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- E. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Main events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
- F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
 2. Changes in early and late start dates.
 3. Changes in early and late finish dates.
 4. Changes in activity durations in workdays.
 5. Changes in the critical path.
 6. Changes in total float or slack time.

7. Changes in the Contract Time.

2.03 THREE WEEK LOOK AHEAD SCHEDULE

- A. Prepare weekly, for the weekly Project meeting, a computer-generated Three-week look ahead schedule (bar chart) which is consistent with the CPM schedule and depicts daily labor activities. The schedule will consist of the prior week, current week, and the following week.

PART 3 - EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting into Project Website.
 - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and other Site locations.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.
- C. Construction Delay:
 - 1. Excusable Delays. If Substantial Completion of the Work is delayed by Excusable Delays, the Contract time shall be subject to adjustment for such reasonable period of time as determined by the Owner and Construction Manager. Excusable Delays shall not result in any increase in the Contract price. Excusable Delays refer to unforeseeable and unavoidable causalities or other unforeseen causes beyond the control, and without fault or neglect, of the Contractor, and subcontractor, material supplier or other person directly or indirectly engaged by the Contractor in performance of any portion of the work. Excusable Delays include unanticipated and unavoidable labor disputes, unusual and unanticipated delays in transportation of equipment, materials or construction equipment reasonably necessary for completion and proper execution of work, and unanticipated unusually adverse weather conditions.

2. **Compensable Delays.** If substantial completion of the work is delayed and such delay is caused by acts or omissions of Owner, Construction Manager, Architect, or separate contractor employed by the Owner (collectively "Compensable Delays"), upon Contractor's request and notice, the Contract time will be adjusted by Change Order for such reasonable period of time as determined by the Owner and Construction Manager. In accordance with California Public Contract Code §7102, if the Contractor's progress is delayed by any of the events described within this provision, Contractor shall not be precluded from the recovery of damages directly and proximately resulting therefrom, provided that Owner is liable for the delay, the delay is unreasonable under the circumstances involved and the delay was not within the reasonable contemplation of Owner and the Contractor at the time of execution of the Agreement.
 3. **Inexcusable Delays.** Inexcusable Delays refer to any delay to the progress of the Work caused by events or factors other than those specifically identified above. Neither the Contract price nor the Contract Time shall be adjusted on account of Inexcusable Delays.
- D. **Adjustment of Contract Time:** If the Contractor believes that others have impacted its work, such that the project completion date will be delayed, the Contractor must submit proof demonstrating the delay to the critical path. The proof, in the form of a Time Impact Analysis, may entitle the Contractor to an adjustment of contract time, by providing the following.
1. The Time Impact Analysis submitted by the Contractor shall utilize the accepted schedule update that is current relative to the time frame of the delay event (change order or other Owner-caused delay). The Contractor shall represent the delay event in the schedule by:
 - a. Inserting new activities associated with the delay event into the schedule;
 - b. Revising activity logic; or
 - c. Revising activity durations.
 2. If the project schedule's critical path and completion date are impacted as a result of adding this delay event to the schedule, a time extension equal to the magnitude of the impact may be warranted.
 3. The Time Impact Analysis submittal shall consist of:
 - a. A fragment of the portion of the schedule affected by the delay event;
 - b. A narrative explanation of the delay issue and how it impacted the schedule; and
 - c. The complete schedule file used to perform the Time Impact Analysis in an electronic format.
- E. Indicate clearly that the Contractor has used, in full, all project float available for the work involved in the request, including any float that may exist between the Contractor's planned completion date and the officially stated Contract completion date. Utilize the latest version of the schedule update accepted at the time of the alleged delay, and all other relevant information, to determine the adjustment of the contract time.
- F. Float shall be for the mutual benefit of the Owner and the Contractor. Adjustment of the Contract times will be granted only when the Contractor float has been fully utilized and only when the revised date of completion of the work has been pushed beyond the contract completion date. Adjustment of the Contract times will be made only for the number of days that the planned completion of the work has been extended.

- G. Actual delays in activities which do not affect the critical path work or which do not move the Contractor's planned completion date beyond the Contract completion date will not be the basis for an adjustment to the Contract time.
- H. The Contractor shall not be entitled to job-site or home office overhead beyond the Contractor's originally planned occupancy of the site if completion of the project occurs within the specified Contract time.
- I. Notify Construction Manager of a request for Contract time adjustment. Submit request within fourteen (14) calendar days of occurrence of the delay event. In cases where the Contractor does not submit a request for Contract time adjustment for a specific change order, delay, or Contractor request within the specified period to time, then it is mutually agreed that the particular change order, delay, or Contractor request has no time impact on the Contract completion date and no time extension is required.
- J. The Construction Manager will, within fourteen (14) calendar days after receipt of a contract time adjustment request, request any supporting evidence, review the facts and advise the Contractor in writing.
- K. The new Progress Schedule data, is accepted by Owner, shall be included in the next monthly Schedule Update submitted into Project Website.

END OF SECTION 01 32 00

SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including FTA Contract Provisions, MTD Master Agreement, and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
 - 3. Final completion construction photographs.

1.03 INFORMATIONAL SUBMITTALS

- A. Digital Photographs: Submit image files within seven days of taking photographs.
 - 1. Digital Camera: Minimum sensor resolution of 8 megapixels.
 - 2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, uncropped, date and time stamped, in folder named by date of photograph.
 - 3. Identification: Provide the following information with each image description in file metadata tag:
 - a. Date photograph was taken.

1.04 QUALITY ASSURANCE

- A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.05 USAGE RIGHTS

- A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.01 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.01 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software into Project Website.
 - 1. Date and Time: Include date and time in file name for each image.
 - 2. Onsite Image Accessibility: All images submitted into Project Website shall be made accessible from the Project Website at all times for reference. Identify images in the same manner as those submitted to Architect and Construction Manager.
- C. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Construction Manager.
 - 1. Take minimum of 40 photographs to show existing conditions adjacent to property before starting the Work.
 - 2. Take minimum of 40 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 - 3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- D. Periodic Construction Photographs: Take minimum of 40 photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

- E. Construction Manager-Directed Construction Photographs: From time to time, Construction Manager will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.
- F. Final Completion Construction Photographs: Take minimum of 100 color photographs after date of Substantial Completion for submission as project record documents. Construction Manager will inform photographer of any additional desired vantage points.
 - 1. Include date stamp.
- G. Additional Photographs: Architect or Construction Manager may request photographs in addition to periodic photographs specified.
 - 1. Three days' notice will be given, where feasible.
 - 2. In emergency situations, take additional photographs within 24 hours of request.
 - 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Substantial Completion of a major phase or component of the Work.

END OF SECTION 01 32 33

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Federal Contract Provisions, MTD Master Agreement, and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:

- 1. Submittal schedule requirements.
- 2. Administrative and procedural requirements for submittals.

- B. Related Requirements:

- 1. Section 01 31 00 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
- 2. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
- 3. Section 01 40 00 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
- 4. Section 01 77 00 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
- 5. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
- 6. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
- 7. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.03 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's and Construction Manager's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.04 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 30 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal Category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's and Construction Manager's final release or approval.
 - g. Scheduled dates for purchasing.
 - h. Scheduled date of fabrication.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.05 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
1. Project name.
 2. Date.
 3. Name of Architect.
 4. Name of Construction Manager.
 5. Name of Contractor.
 6. Name of firm or entity that prepared submittal.
 7. Names of subcontractor, manufacturer, and supplier.
 8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
 9. Category and type of submittal.

10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

- B. Options: Identify options requiring selection by Architect.
- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect and Construction Manager on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number and submit into Project Website.

1.06 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 1. Project Website: Prepare submittals as PDF package and transmit to Architect through Project Website. Include PDF transmittal form. Include information in subject line as requested by Architect.
 - a. Architect, through Construction Manager, will return annotated file. Annotate and retain copy of file as a digital Project Record Document file.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.

- a. Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Construction Manager's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 - 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
 - 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's and Construction Manager's action stamp.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Ensure complete copies of submittals accessible from Project Website onsite. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

1.07 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:

- a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 - 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 - 5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
- 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 - 2. Paper Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
- C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
- 1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
 - 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.

- e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
3. Project Website Transmittal: Provide PDF transmittal through the Project Website. Include digital image file illustrating Sample characteristics and identification information for record.
 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return submittal with options selected.
 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.

3. Number and name of room or space.
 4. Location within room or space.
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
 2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
 5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
 6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.
- H. Test and Research Reports:
1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
 2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
 3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

1.08 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
 1. Architect and Construction Manager will not review submittals received from Contractor that do not have Contractor's review and approval.

1.09 ARCHITECT'S AND CONSTRUCTION MANAGER'S REVIEW

- A. Action Submittals: Architect and Construction Manager will review each submittal, indicate corrections or revisions required, and return.
 1. PDF Submittals: Architect and Construction Manager will indicate, via markup on each submittal, the appropriate action.
- B. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.

- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect and Construction Manager.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Architect and Construction Manager will discard submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including FTA Contract Provisions, MTD Master Agreement, and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Owner, Construction Manager, Architect, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.

1.03 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect or Construction Manager.

- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
 2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.04 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Construction Manager for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Construction Manager for a decision before proceeding.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Contractor's quality-control personnel.
- B. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.06 REPORTS AND DOCUMENTS

- A. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of technical representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Statement that products at Project site comply with requirements.
 - 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 6. Statement whether conditions, products, and installation will affect warranty.
 - 7. Other required items indicated in individual Specification Sections.

- B. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of factory-authorized service representative making report.
 - 2. Statement that equipment complies with requirements.
 - 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 4. Statement whether conditions, products, and installation will affect warranty.
 - 5. Other required items indicated in individual Specification Sections.
- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- E. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

- F. **Manufacturer's Technical Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- G. **Factory-Authorized Service Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- H. **Preconstruction Testing:** Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.
 2. **Testing Agency Responsibilities:** Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through Construction Manager, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- I. **Mockups:** Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect or Construction Manager.
 2. Notify Architect and Construction Manager seven days in advance of dates and times when mockups will be constructed.
 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 4. Obtain Architect's and Construction Manager's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 6. Demolish and remove mockups when directed unless otherwise indicated.

1.08 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."
- C. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.09 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Conducted by a qualified special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Construction Manager and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Construction Manager with copy to Contractor and to authorities having jurisdiction.
 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Test and Inspection Log on Project Website. Post changes and revisions as they occur in the Project Website. Ensure access to Project Website and Test and Inspection Log for Architect's and Construction Manager's reference during normal working hours.

3.02 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including FTA Contract Provisions, MTD Master Agreement, and other Division 01 Specification Sections, apply to this Section.

1.02 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Construction Manager and/or Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.03 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.04 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
 - 1. AABC - Associated Air Balance Council; www.aabc.com.
 - 2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
 - 3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
 - 4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
 - 5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
 - 6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
 - 7. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
 - 8. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
 - 9. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
 - 10. AF&PA - American Forest & Paper Association; www.afandpa.org.
 - 11. AGA - American Gas Association; www.aga.org.
 - 12. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
 - 13. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
 - 14. AI - Asphalt Institute; www.asphaltinstitute.org.
 - 15. AIA - American Institute of Architects (The); www.aia.org.
 - 16. AISC - American Institute of Steel Construction; www.aisc.org.
 - 17. AISI - American Iron and Steel Institute; www.steel.org.
 - 18. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
 - 19. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.

20. ANSI - American National Standards Institute; www.ansi.org.
21. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
22. APA - APA - The Engineered Wood Association; www.apawood.org.
23. APA - Architectural Precast Association; www.archprecast.org.
24. API - American Petroleum Institute; www.api.org.
25. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
26. ARI - American Refrigeration Institute; (See AHRI).
27. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
28. ASCE - American Society of Civil Engineers; www.asce.org.
29. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
30. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
31. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
32. ASSE - American Society of Safety Engineers (The); www.asse.org.
33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
34. ASTM - ASTM International; (American Society for Testing and Materials International); www.astm.org.
35. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
36. AWEA - American Wind Energy Association; www.awea.org.
37. AWI - Architectural Woodwork Institute; www.awinet.org.
38. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
39. AWPAA - American Wood Protection Association; (Formerly: American Wood-Preservers' Association); www.awpa.com.
40. AWS - American Welding Society; www.aws.org.
41. AWWA - American Water Works Association; www.awwa.org.
42. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
43. BIA - Brick Industry Association (The); www.gobrick.com.
44. BICSI - BICSI, Inc.; www.bicsi.org.
45. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.com.
46. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
47. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bwfbadminton.org.
48. CDA - Copper Development Association; www.copper.org.
49. CEA - Canadian Electricity Association; www.electricity.ca.
50. CEA - Consumer Electronics Association; www.ce.org.
51. CFFA - Chemical Fabrics & Film Association, Inc.; www.chemicalfabricsandfilm.com.
52. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
53. CGA - Compressed Gas Association; www.cganet.com.
54. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
55. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
56. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
57. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
58. CPA - Composite Panel Association; www.pbmdf.com.
59. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
60. CRRC - Cool Roof Rating Council; www.coolroofs.org.

61. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
62. CSA - Canadian Standards Association; www.csa.ca.
63. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
64. CSI - Construction Specifications Institute (The); www.csinet.org.
65. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
66. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
67. CWC - Composite Wood Council; (See CPA).
68. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
69. DHI - Door and Hardware Institute; www.dhi.org.
70. ECA - Electronic Components Association; (See ECIA).
71. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
72. ECIA - Electronic Components Industry Association; www.eciaonline.org
73. EIA - Electronic Industries Alliance; (See TIA).
74. EIMA - EIFS Industry Members Association; www.eima.com.
75. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
76. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
77. ESTA - Entertainment Services and Technology Association; (See PLASA).
78. EVO - Efficiency Valuation Organization; www.evo-world.org.
79. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
80. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
81. FM Approvals - FM Approvals LLC; www.fmglobal.com.
82. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
83. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridarroof.com.
84. FSA - Fluid Sealing Association; www.fluidsealing.com.
85. FSC - Forest Stewardship Council U.S.; www.fscus.org.
86. GA - Gypsum Association; www.gypsum.org.
87. GANA - Glass Association of North America; www.glasswebsite.com.
88. GS - Green Seal; www.greenseal.org.
89. HI - Hydraulic Institute; www.pumps.org.
90. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
91. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
92. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
93. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
94. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
95. IAS - International Accreditation Service; www.iasonline.org.
96. IAS - International Approval Services; (See CSA).
97. ICBO - International Conference of Building Officials; (See ICC).
98. ICC - International Code Council; www.iccsafe.org.
99. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
100. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
101. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
102. IEC - International Electrotechnical Commission; www.iec.ch.

103. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
104. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
105. IESNA - Illuminating Engineering Society of North America; (See IES).
106. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
107. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
108. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
109. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
110. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
111. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
112. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
113. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
114. ISO - International Organization for Standardization; www.iso.org.
115. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
116. ITU - International Telecommunication Union; www.itu.int/home.
117. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
118. LMA - Laminating Materials Association; (See CPA).
119. LPI - Lightning Protection Institute; www.lightning.org.
120. MBMA - Metal Building Manufacturers Association; www.mbma.com.
121. MCA - Metal Construction Association; www.metalconstruction.org.
122. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
123. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
124. MHIA - Material Handling Industry of America; www.mhia.org.
125. MIA - Marble Institute of America; www.marble-institute.com.
126. MMPA - Moulding & Millwork Producers Association; (Formerly: Wood Moulding & Millwork Producers Association); www.wmmpa.com.
127. MPI - Master Painters Institute; www.paintinfo.com.
128. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
129. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
130. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
131. NADCA - National Air Duct Cleaners Association; www.nadca.com.
132. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
133. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
134. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
135. NCMA - National Concrete Masonry Association; www.ncma.org.
136. NEBB - National Environmental Balancing Bureau; www.nebb.org.
137. NECA - National Electrical Contractors Association; www.necanet.org.
138. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
139. NEMA - National Electrical Manufacturers Association; www.nema.org.
140. NETA - InterNational Electrical Testing Association; www.netaworld.org.
141. NFHS - National Federation of State High School Associations; www.nfhs.org.
142. NFPA - NFPA; (National Fire Protection Association); www.nfpa.org.
143. NFPA - NFPA International; (See NFPA).

144. NFRC - National Fenestration Rating Council; www.nfrc.org.
145. NHLA - National Hardwood Lumber Association; www.nhla.com.
146. NLGA - National Lumber Grades Authority; www.nlga.org.
147. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
148. NOMMA - National Ornamental & Miscellaneous Metals Association;
www.nomma.org.
149. NRCA - National Roofing Contractors Association; www.nrca.net.
150. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
151. NSF - NSF International; (National Sanitation Foundation International);
www.nsf.org.
152. NSPE - National Society of Professional Engineers; www.nspe.org.
153. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
154. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
155. NWFA - National Wood Flooring Association; www.nwfa.org.
156. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
157. PDI - Plumbing & Drainage Institute; www.pdionline.org.
158. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
159. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
160. RFCI - Resilient Floor Covering Institute; www.rfci.com.
161. RIS - Redwood Inspection Service; www.redwoodinspection.com.
162. SAE - SAE International; (Society of Automotive Engineers); www.sae.org.
163. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
164. SDI - Steel Deck Institute; www.sdi.org.
165. SDI - Steel Door Institute; www.steeldoors.org.
166. SEFA - Scientific Equipment and Furniture Association; www.sefalabs.com.
167. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers;
(See ASCE).
168. SIA - Security Industry Association; www.siaonline.org.
169. SJI - Steel Joist Institute; www.steeljoist.org.
170. SMA - Screen Manufacturers Association; www.smainfo.org.
171. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association;
www.smacna.org.
172. SMPTE - Society of Motion Picture and Television Engineers; www.smppte.org.
173. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
174. SPIB - Southern Pine Inspection Bureau; www.spib.org.
175. SPRI - Single Ply Roofing Industry; www.spri.org.
176. SRCC - Solar Rating and Certification Corporation; www.solar-rating.org.
177. SSINA - Specialty Steel Industry of North America; www.ssina.com.
178. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
179. STI - Steel Tank Institute; www.steeltank.com.
180. SWI - Steel Window Institute; www.steelwindows.com.
181. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
182. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
183. TCNA - Tile Council of North America, Inc.; (Formerly: Tile Council of America);
www.tileusa.com.
184. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
185. TIA - Telecommunications Industry Association; (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance);
www.tiaonline.org.

186. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
187. TMS - The Masonry Society; www.masonrysociety.org.
188. TPI - Truss Plate Institute; www.tpinst.org.
189. TPI - Turfgrass Producers International; www.turfgrasssod.org.
190. TRI - Tile Roofing Institute; (Formerly: National Tile Roofing Manufacturing Association); www.tilerroofing.org.
191. UBC - Uniform Building Code; (See ICC).
192. UL - Underwriters Laboratories Inc.; www.ul.com.
193. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
194. USAV - USA Volleyball; www.usavolleyball.org.
195. USGBC - U.S. Green Building Council; www.usgbc.org.
196. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
197. WASTEC - Waste Equipment Technology Association; www.wastec.org.
198. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
199. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
200. WDMA - Window & Door Manufacturers Association; www.wdma.com.
201. WI - Woodwork Institute; (Formerly: WIC - Woodwork Institute of California); www.wicnet.org.
202. WMMPA - Wood Moulding & Millwork Producers Association; (See MMPA).
203. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
204. WPA - Western Wood Products Association; www.wwpa.org.

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
2. ICC - International Code Council; www.iccsafe.org.
3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up-to-date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; <http://dodssp.daps.dla.mil>.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. OSHA - Occupational Safety & Health Administration; www.osha.gov.
12. SD - Department of State; www.state.gov.

13. TRB - Transportation Research Board; National Cooperative Highway Research Program; www.trb.org.
14. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
15. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
16. USP - U.S. Pharmacopeia; www.usp.org.
17. USPS - United States Postal Service; www.usps.com.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. FED-STD - Federal Standard; (See FS).
3. USAB - United States Access Board; www.access-board.gov.
4. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic Appliance and Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
3. CDHS; California Department of Health Services; (See CDPH).
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 43 39 - MOCKUPS

PART 1 - GENERAL

1.01 DEFINITIONS

- A. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1.02 QUALITY ASSURANCE

- A. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in location and of size indicated or, if not indicated, as directed by Construction Manager.
 - 2. Notify Construction Manager not less than seven days in advance of dates and times when mockups will be constructed.
 - 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
 - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 5. Obtain Construction Manager's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 - 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 7. Demolish and remove mockups when directed by Construction Manager unless otherwise indicated.

PART 2 - PRODUCTS

PART 3 - EXECUTION[(Not Used)]

END OF SECTION 01 43 39

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including FTA Contract Provisions, MTD Master Agreement, and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.

1.03 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Construction Manager, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.04 INFORMATIONAL SUBMITTALS

- A. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1.05 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.06 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide galvanized-steel bases for supporting posts.
- B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

2.02 TEMPORARY FACILITIES

- A. Storage and Fabrication Sheds: If required, provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations. Locations and sizes to be coordinated with acceptable impacts to Owner's operations and contingent on space available.

- 1. Store combustible materials apart from building.

2.03 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

- A. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- B. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

3.03 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- C. Waste Disposal Facilities: Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."
- D. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
 - 1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
 - 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 - 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
 - 4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- D. Tree and Plant Protection: Comply with requirements specified in Section 01 56 39 "Temporary Tree and Plant Protection."
- E. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner and Construction Manager.
- F. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- G. Temporary Egress: Maintain egress from existing occupied facilities as required by authorities having jurisdiction.

3.05 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 - 2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 56 39 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including FTA Contract Provisions, MTD Master Agreement, and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.
- B. Related Requirements:
 - 1. Section 01 50 00 "Temporary Facilities and Controls" for temporary site fencing.

1.03 DEFINITIONS

- A. Caliper: Diameter of a trunk measured by a diameter tape at a height 6 inches above the ground for trees up to and including 4-inch size at this height and as measured at a height of 12 inches above the ground for trees larger than 4-inch size.
- B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.
- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
 - a. Quality-control program.
 - b. Coordination of Work and equipment movement with the locations of protection zones.
 - c. Trenching by hand or with air spade within protection zones.
 - d. Field quality control.

1.05 INFORMATIONAL SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
 - 1. Use sufficiently detailed photographs or video recordings.
 - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.06 FIELD CONDITIONS

- A. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Moving or parking vehicles or equipment.
 - 3. Erection of sheds or structures.
 - 4. Impoundment of water.
 - 5. Excavation or other digging unless otherwise indicated.
 - 6. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Backfill Soil: Planting soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.
 - 1. Planting Soil: Planting soil as specified in Landscape specifications.
- B. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements: Previously used materials may be used when approved by Construction Manager.
 - 1. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 96 inches apart.

- a. Height: 48 inches.
- b. Color: High-visibility orange, nonfading.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.02 PREPARATION

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag each tree trunk at 54 inches above the ground.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.
 - 1. Apply 4-inch uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches of tree trunks.

3.03 PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
 - 1. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Construction Manager.
- B. Maintain protection zones free of weeds and trash.

- C. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.
 - 1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.

3.04 EXCAVATION

- A. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.
- B. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.
- C. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.05 ROOT PRUNING

- A. Prune tree roots that are affected by temporary and permanent construction, such as utility line or footing installation/construction. Prune roots as follows:
 - 1. Definitions:
 - a. Critical Root Zone: a circle scribed about the center of the tree having a radius of one foot for every inch of trunk diameter at breast height (DBH).
 - b. Root Crown: The point at which the root and stem of the tree meet and the primary vascular anatomy changes from that of a stem to that of a root.
 - 2. Root pruning shall occur concurrent with site clearing or trench excavation in all areas where new utility or wall installation occurring near trees requires pruning or removal of roots.
 - 3. All root removal shall be limited to the extent possible. No surface roots over 2" in diameter shall be cut within the tree critical root zone.
 - 4. Installation of utility lines or footings shall be performed by boring or tunneling below the surface tree roots within the critical root zone in order to preserve the main woody anchorage and feeding roots.
 - 5. Roots shall be cut cleanly with a mechanical trenching device similar to a root saw, followed immediately by a clean-cut hand pruning of all roots greater than ½" and less than 2" in diameter; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots. All pruned/cut roots shall be covered as soon as possible with topsoil, mulch, or other organic medium

or covered to the extent possible with 6 mil plastic or wet burlap to retard soil and root dehydration. Maintain adequate moisture to surface feeder roots.

6. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 7. Beginning two weeks prior to root pruning and through substantial completion of the project, all impacted trees shall be watered by mechanical irrigation or manually at a rate equivalent to one inch of water per week, adjusted as required for local weather conditions.
- B. Root Pruning at Edge of Protection Zone: Prune tree roots 12 inches outside of the protection zone by cleanly cutting all roots to the depth of the required excavation.
- C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.06 REGRADING

- A. Minor Fill within Protection Zone: Where existing grade is 6 inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.07 FIELD QUALITY CONTROL

- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.08 TREE REMOVAL

- A. In the event that an existing tree to be protected must be removed, Review with Owner and Landscape Architect prior to removal.
- B. The Contractor shall refrain from the practice of "free falling" the trees. All trees shall be limbed out prior to the final cutting of the trunk. Concrete walks, lights, streets, planter walls, site furnishings, and other manmade structures and plant materials shall always be protected from the impact of falling wood by use of tree or limb ground supports. Ropes or other mechanical devices shall be used to lower all limbs of sufficient size that may cause damage to other trees or surrounding property.
- C. Limbs and trunks temporarily placed in the construction site shall be placed in such a manner as to eliminate any obstruction to motor vehicles and pedestrians. Contractor shall store deleterious material within construction cone boundary and remove it at the end of each day. Brush and limbs overhanging a curb or pavement in the public right of way shall not be acceptable and under no circumstances shall these materials be allowed to remain on site overnight.

- D. All infectious diseased or parts of dead trees possibly harboring vector of infectious diseases shall be removed from the property grounds and shall become the Contractor's responsibility to ensure destruction of the diseased or dead wood in accordance with the State statutes and local ordinances.
- E. Trees in the line of utility trenches, new pavement, walls, etc., called out for removal shall be removed by mechanical means. Contractor shall either pull out or stump grind trees called out to be removed on the plans. Stump grinding shall be performed at least 6" below finish surface grade. Fill in excavation pits or grind area with soil and install plant material as directed per plans.

3.09 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 01 56 39

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including FTA Contract Provisions, MTD Master Agreement, and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 01 25 00 "Substitution Procedures" for requests for substitutions.
 - 2. Section 01 42 00 "References" for applicable industry standards for products specified.

1.03 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.04 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor through Construction Manager of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Section 01 33 00 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 "Submittal Procedures." Show compliance with requirements.

1.05 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

1.07 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

2.02 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.

3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 60 01 - BUY AMERICA REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including FTA Contract Provisions, MTD Master Agreement, and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. The Buy America requirements including the provisions of 49 U.S.C. Section 5323(j) and 49 CFR Part 661 apply to this Project.
- B. This Project is partially funded by the FTA. No funds will be obligated by FTA for Owner's (grantee's) Project unless all iron, steel, and manufactured products used in the project are produced in the United States, unless a waiver has been granted by FTA or the product is subject to a general waiver.
 - 1. For waiver requirements see:
 - a. 49 CFR Part 661.7 Waivers.
 - b. 49 U.S.C. Section 5323(j)(2) Waiver.
 - 2. Recently published waivers may be viewed at URL's (web address) including, but not limited to, the following:
 - a. <https://www.transit.dot.gov/regulations-and-guidance/buy-america/waivers-granted> .
 - b. General Waivers:
 - 1) <https://www.law.cornell.edu/cfr/text/48/25.104> .
 - 2) <https://www.law.cornell.edu/cfr/text/49/661.7> .
- C. All products furnished for this Project shall comply with Buy America regardless of value.
- D. If a lower tier contractor discovers that a specified product - whether indicated in a specification section or on a drawing - does not meet Buy America requirements they shall immediately notify General Contractor in writing.
- E. Each lower tier contractor shall include a Buy America certificate with their product submittals in the form indicated under Part 2 below.

1.03 REFERENCES

A. CFR - Code of Federal Regulations (<https://www.gpo.gov>):

1. 49 CFR Part 661 - BUY AMERICA REQUIREMENTS.

B. FTA - Federal Transit Administration:

1. Johnson, J.P. (Sept. 2001). Guide to Federal Buy America Requirements. Legal Research Digest, September 2001 - Number 17, by Transit Cooperative Research Program (TCRP) Sponsored by the FTA.
2. Johnson, J.P (Mar. 2010). Guide to Federal Buy America Requirements - 2009 Supplement. Legal Research Digest 31, March 2010 - by Transit Cooperative Research Program (TCRP) Sponsored by the FTA.
3. Wyatt, Timothy R. (May 2017). Updated Guide to Buy America Requirements - 2015 Supplement. Legal Research Digest 49, May 2017 - by Transit Cooperative Research Program (TCRP) Sponsored by the FTA. (PDF available at <http://nap.edu/24780>)

C. U.S.C. - United States Code (<https://www.gpo.gov>):

1. 49 U.S.C. Section 5323(j) Buy America.

PART 2 - PRODUCTS

2.01 BUY AMERICA CERTIFICATE: Include following on company letterhead:

BUY AMERICA CERTIFICATE

Certification requirement for procurement of steel, iron, or manufactured products.

Certificate of Compliance with 49 U.S.C. Section 5323(j)(1).

The bidder or offeror hereby certifies that it will meet the requirements of 49 U.S.C. Section 5323 (j)(1) and the applicable regulations in 49 CFR Part 661.5.

Date: _____

Signature: _____

Company Name: _____

Title: _____

Certificate of Non-Compliance with 49 U.S.C. 5323(j)(1).

The bidder or offeror hereby certifies that it cannot comply with the requirements of 49 U.S.C. Section 5323(j)(1) and 49 C.F.R. 661.5, but it may qualify for an exception pursuant to 49 U.S.C. Sections 5323(j)(2)(A), 5323(j)(2)(B), or 5323(j)(2)(D), and 49 CFR 661.7.

Date: _____

Signature: _____

Company Name: _____

Title: _____

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 01

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including FTA Contract Provisions, MTD Master Agreement, and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Installation of the Work.
 - 2. Cutting and patching.
 - 3. Coordination of Owner-installed products.
 - 4. Progress cleaning.
 - 5. Starting and adjusting.
 - 6. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 01 10 00 "Summary" for limits on use of Project site.
 - 2. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
 - 3. Section 02 41 19 "Selective Demolition" for demolition and removal of selected portions of the building.

1.03 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.04 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Construction Manager of locations and details of cutting and await directions from Construction Manager before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
 - a. Control systems.
 - b. Communication systems.
 - c. Fire-detection and -alarm systems.
 - d. Electrical wiring systems.
 3. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work.
 2. List of detrimental conditions, including substrates.
 3. List of unacceptable installation tolerances.
 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 31 00 "Project Management and Coordination."

3.03 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Construction Manager promptly.
- B. General: Engage a to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - 6. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

3.04 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.05 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00 "Summary."

- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.06 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.07 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.08 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components.
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.09 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 73 00

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including FTA Contract Provisions, MTD Master Agreement, and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Recycling nonhazardous demolition construction waste.
 - 2. Disposing of nonhazardous demolition construction waste.

1.03 DEFINITIONS

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.
- C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

1.04 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.

1.05 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.

1.06 INFORMATIONAL SUBMITTALS

- A. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- B. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.07 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - 2. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - 3. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. General: Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:
 - 1. Demolition Waste:
 - a. Concrete.
 - b. Concrete reinforcing steel.
 - c. Concrete masonry units.
 - d. Structural and miscellaneous steel.
 - e. Rough hardware.
 - f. Roofing.

- g. Gypsum board.
- h. Acoustical tile and panels.
- i. Equipment.
- j. Plumbing fixtures.
- k. Piping.
- l. Mechanical equipment.
- m. Electrical conduit.
- n. Copper wiring.
- o. Lighting fixtures.
- p. Electrical devices.
- q. Switchgear and panelboards.

2. Construction Waste:

- a. Lumber.
- b. Metals.
- c. Roofing.
- d. Electrical conduit.
- e. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - 1) Paper.
 - 2) Cardboard.
 - 3) Boxes.
 - 4) Wood crates.
 - 5) Wood pallets.

PART 3 - EXECUTION

3.01 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 1. Comply with operation, termination, and removal requirements in Section 01 50 00 "Temporary Facilities and Controls."
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
 - 1. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
 - 2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.02 RECYCLING DEMOLITION CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 2. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.03 RECYCLING DEMOLITION WASTE

- A. Metals: Separate metals by type.
- B. Conduit: Reduce conduit to straight lengths and store by material and size.

3.04 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.

2. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
3. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

3.05 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of offsite.
- C. Burning: Do not burn waste materials.

END OF SECTION 01 74 19

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including FTA Contract Provisions, MTD Master Agreement, and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Section 01 73 00 "Execution" for progress cleaning of Project site.
 - 2. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 4. Section 01 79 00 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.03 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.04 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.06 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Construction Manager. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Construction Manager's signature for receipt of submittals.
 - 5. Submit test/adjust/balance records.
 - 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.

5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
6. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
7. Complete final cleaning requirements, including touchup painting.
8. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

1.07 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 8 of Contract Master Agreement.
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

1.08 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Contractor.
 - d. Page number.
 4. Submit list of incomplete items in the following format:
 - a. MS Excel electronic file. Architect, through Construction Manager, will return annotated file.
 - b. PDF electronic file. Architect, through Construction Manager, will return annotated file.

1.09 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Construction Manager and/or Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.01 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in all areas including those not disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - d. Remove labels that are not permanent.
 - e. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - f. Clean all building interiors, including those not impacted otherwise by construction activities.
 - g. Leave Project clean and ready for occupancy.
- C. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."

3.02 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 77 00

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including FTA Contract Provisions, MTD Master Agreement, and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Operation manuals for systems, subsystems, and equipment.
 - 3. Product maintenance manuals.
- B. Related Requirements:
 - 1. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.03 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.04 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect and Construction Manager will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Construction Manager will comment on whether general scope and content of manual are acceptable.

- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Construction Manager will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's and Construction Manager's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Construction Manager's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.01 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
 - 1. List of documents.
 - 2. List of systems.
 - 3. List of equipment.
 - 4. Table of contents.
- B. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- C. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- D. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents.

2.02 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:

1. Product name and model number.
 2. Manufacturer's name.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Schedule for routine cleaning and maintenance.

PART 3 - EXECUTION

3.01 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of operation and maintenance manuals.
 2. Comply with requirements of newly prepared record Drawings in Section 01 78 39 "Project Record Documents."

- F. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including FTA Contract Provisions, MTD Master Agreement, and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:

- 1. Record Drawings.
- 2. Record Specifications.
- 3. Record Product Data.
- 4. Miscellaneous record submittals.

- B. Related Requirements:

- 1. Section 01 73 00 "Execution" for final property survey.
- 2. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
- 3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.03 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:

- 1. Number of Copies: Submit one set(s) of marked-up record prints.
- 2. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit PDF electronic files of scanned record prints and one of file prints.
 - 2) Submit record digital data files and one set(s) of plots.
 - 3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit one paper-copy set(s) of marked-up record prints.
 - 2) Submit PDF electronic files of scanned record prints and three set(s) of prints.

- 3) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit of each submittal.
- E. Reports: Submit written report indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.01 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Locations and depths of underground utilities.
 - d. Revisions to electrical circuitry.
 - e. Changes made by Change Order or Construction Change Directive.

- f. Changes made following Architect's written orders.
 - g. Details not on the original Contract Drawings.
 - h. Field records for variable and concealed conditions.
 - i. Record information on the Work that is shown only schematically.
 - 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 - 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
- 1. Format: Annotated PDF electronic file with comment function enabled.
 - 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 - 3. Refer instances of uncertainty to Architect through Construction Manager for resolution.
 - 4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
 - a. See Section 01 33 00 "Submittal Procedures" for requirements related to use of Architect's digital data files.
 - b. Architect will provide data file layer information. Record markups in separate layers.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
- 1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - 2. Format: Annotated PDF electronic file with comment function enabled.
 - 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 - 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect and Construction Manager.

- e. Name of Contractor.

2.02 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 - 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 - 5. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file.

2.03 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as annotated PDF electronic file.
 - 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.04 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. File miscellaneous records and identify each, ready for continued use and reference in Project Website.
- B. Format: Submit miscellaneous record submittals as PDF electronic file.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.01 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's and Construction Manager's reference during normal working hours.

END OF SECTION 01 78 39

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including FTA Contract Provisions, MTD Master Agreement, and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.

1.03 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.04 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

1.05 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.01 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
 - 3. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
 - 4. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.

- c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
5. Repairs: Include the following:
- a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."

3.02 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.
- C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

END OF SECTION 01 79 00

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.

B. Related Requirements:

1. Section 01 10 00 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 01 35 16 "Alteration Project Procedures" for general protection and work procedures for alteration projects.
3. Section 02 82 00 "Regulated and Hazardous Materials" for lead paint and asbestos abatement work.

1.02 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.03 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.04 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection , for dust control and , for noise control. Indicate proposed locations and construction of barriers.
- B. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations. Comply with Section 01 32 33 "Photographic Documentation." Submit before Work begins.

1.05 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
 - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
 - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
 - 3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1.06 COORDINATION

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

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.
- C. Sustainable Design Requirements for Building Reuse:
 - 1. Maintain existing interior nonstructural elements (interior walls, doors, floor coverings, and ceiling systems) not indicated to be demolished; do not demolish such existing construction beyond indicated limits.
 - 2. Maintain the existing building structure, envelope, and interior nonstructural elements of a historic building or contributing building in a historic district. Do not demolish such existing construction beyond indicated limits.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.
 - 1. Inventory and record the condition of items to be removed and salvaged.
 - 2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.02 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.03 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off utilities with utility companies.
 - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Disconnect, demolish, and remove electrical, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Equipment to Be Removed: Disconnect and cap services and remove equipment.

3.04 PROTECTION

- A. Remove temporary barricades and protections where hazards no longer exist.

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. 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 fire watch during and for at least two hours after flame-cutting operations.
 - 6. Maintain adequate ventilation when using cutting torches.
 - 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 - 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

10. Dispose of demolished items and materials promptly. Comply with requirements in Section 01 74 19 "Construction Waste Management and Disposal."

- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.06 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."
- E. Roofing:
 - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
 - 2. Remove existing roofing system down to substrate.

3.07 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction. and recycle or dispose of them according to Section 01 74 19 "Construction Waste Management and Disposal."
 - 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.
 - 4. Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

- B. Burning: Do not burn demolished materials.

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.

END OF SECTION 02 41 19

SECTION 02 82 00 - REGULATED AND HAZARDOUS MATERIALS

PART 1 - GENERAL

1.01 SUMMARY

- A. The purpose of the work described in this section is to abate and/or stabilize regulated and hazardous building materials (asbestos, lead paint, mercury, polychlorinated biphenols [PCBs], etc.) contained within the building structure that may be affected in the completion of the scope of work described in the Section 01 10 00 SUMMARY. As part of the base scope of work, the CONTRACTOR shall be responsible for the removal, transport, and disposal or recycling of all designated items, unless otherwise stipulated, regardless of the actual quantities.
- B. The CONTRACTOR shall furnish all labor, materials, equipment, and related items required to remove/abate all substances which will be affected by the project and are regulated under federal, state, and local statutes and land ban restrictions to the contract limits as designated herein.
 - 1. Only materials disturbed by the Project work are to be abated by the CONTRACTOR. Hazardous materials identified elsewhere at the Project site but are otherwise not disturbed or contacted as a part of the Project are to remain in place.
- C. Information pertaining to the type, location, and estimated quantities of regulated or hazardous materials is provided in the following documents. These reports are limited in nature and the CONTRACTOR has a duty to understand the limitations of these documents and in its professional judgment determine the presence of hazardous materials that may not be identified in the reports. These reports form an integral part of this specification and are included herein by reference.
 - 1. *Asbestos & Lead Survey Report, Santa Barbara MTD Terminal 2*, prepared by FCG Environmental dated June 15, 2022. Report is included in Project Manual Appendix A.

1.02 related sections

- A. Division 01 – General Requirements
- B. Section 01 33 00 – Submittal Procedures
- C. Section 01 45 00 – Quality Requirements
- D. Section 02 41 19 – Selective Demolition
- E. Section 09 90 00 – Painting

1.03 RELATED REQUIREMENTS

- A. Comply with applicable Federal and State Occupational Safety and Health regulations and environmental statutes. Comply with applicable State regulations and codes, and any municipal requirements. Some regulations and industry guidelines that are applicable to this project include, but are not limited to the following:

1. Code of Federal Regulations (CFR)

- a. 29 CFR 1926 - Safety and Health Regulations for Construction.
- b. 29 CFR 1910 - Safety and Health Regulations for General Industry.
- c. 29 CFR 1910.1020 - Access to Employee Exposure and Medical Records.
- d. 29 CFR 1910.1025 - Lead, General Industry.
- e. 29 CFR 1910.134 - Respiratory Protection.
- f. 29 CFR 1910.145 - Specifications for Accident Prevention Signs and Tags.
- g. 29 CFR 1910.1001 - Asbestos.
- h. 29 CFR 1910.1200 - Hazard Communication
- i. 29 CFR 1926.55 - Gases, Vapors, Fumes, Dusts and Mists
- j. 29 CFR 1926.62 - Lead - Construction Industry
- k. 29 CFR 1926.1101 - Safety and Health Regulations for Construction - Asbestos.
- l. 34 CFR 231 Appendix C - Procedures for Containing and Removing Building Materials Containing Asbestos.
- m. 40 CFR 61 - Subpart A and Subpart M, USEPA, National Emission Standards for Hazardous Air Pollutants (NESHAPS).
- n. 40 CFR 745 – Lead-Based Paint Poisoning Prevention in Certain Residential Structures.
- o. 40 CFR 763 – Asbestos Hazard Emergency Response Act

2. California Code of Regulations (CCR)

- a. Title 8, Section 1230 - Temperature, Illumination, Sanitation and Ventilation.
- b. Title 8, Section 1529 - Asbestos.
- c. Title 8, Section 1531 - Respiratory Protective Equipment.
- d. Title 8, Section 1532.1 - Lead in the Construction Industry
- e. Title 8, Section 3203 - Injury and Illness Prevention Program.
- f. Title 8, Section 3204 - Access to Employee Exposure and Medical Records.
- g. Title 8, Section 5144 - Respiratory Protection.
- h. Title 8, Section 5216 - General Industry Safety Orders, Lead Regulations.
- i. Title 8, Section 5194 - Hazard Communication.
- j. Title 8, Article 2.5 - Registration Asbestos-Related Work Section 341.6 through 341.14.
- k. Title 8, Section 5208 - Asbestos.
- l. Title 17 Sections 35001-36100 - Accreditation, Certification and Work Practices for Lead Based Paint and Lead Hazards
- m. Title 22, Division 4.5 - Minimum Standards for Management of Hazardous and Extremely Hazardous Waste.
- n. Title 22, Section 67740 - Waste Analysis and Record Keeping.

3. Local Air Pollution Control District Regulations

- a. Santa Barbara County Air Pollution Control District (SBCAPCD)
 - b. South Coast Air Quality management District (SCAQMD)
4. Other Local Regulations
- a. California Health and Safety Code, Sections 13121 and 13144.1.
 - b. California Health and Safety Code, Sections 25249-25249.13 and 25915-25919.7.
5. American National Standards Institute (ANSI)
- a. ANSI WK 4519 - Personal Protective Footwear.
 - b. ANSI Z9.2 - Fundamentals Governing the Design and Operation of Local Exhaust and Ventilation Systems.
 - c. ANSI Z87.1 - Practice for Occupational and Educational Personal Eye and Face Protection Devices.
 - d. ANSI Z88.2 - Practices for Respiratory Protection.
 - e. ANSI Z88.6 - Respiratory Protection: Respiratory Use Physical Qualifications for Personnel.
 - f. ANSI Z89.1 - Industrial Head Protection.
6. American Society for Testing and Materials (ASTM)
- a. ASTM D1331 - Test Methods for Surface and Interfacial Tension of Solutions of Surface-Active Agents.
 - b. ASTM E1368 – Standard Practice for Visual Inspection of Asbestos Abatement Projects
 - c. ASTM E1494 - Practice for Encapsulants for Spray- or Trowel-Applied Friable Asbestos-Containing Building Materials.
7. Compressed Gas Association, Inc.
- a. G-7.1 - Commodity Specification for Air.
8. National Fire Protection Association (NFPA)
- a. NFPA 70 - National Electric Code.
9. Underwriters Laboratories, Inc.
- a. UL 586 - Test Performance of High Efficiency Particulate Air Filter Units.
10. National Institute for Occupation Safety and Health (NIOSH)
- a. Method 7400: Asbestos and Fibers by PCM
 - b. Method 7082: Lead by Flame AAS
11. Environmental Protection Agency Documents
- a. EPA 530-SW-85-007 - Asbestos Waste Management Guidance.

- b. EPA EPA 560/5-85-024 - Fundamentals Governing the Design and Operation of Local Exhaust Systems Asbestos Waste Management Guidance.
- c. EPA 560 OPTS-86.001 - Guide to Respiratory Protection for the Asbestos Abatement Industry.
- d. Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, US Housing and Urban Development (HUD)

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination

- 1. Contractor shall coordinate all remedial action work with the Owner, tenants and Agencies Having Jurisdiction as required.
- 2. Prior to the start of this work in major areas of the Project the Contractor shall hold a Pre-Installation meeting in accordance with the Project requirements.

1.05 SUBMITTALS

A. At least 15 days prior to the commencement of the Work, the CONTRACTOR must submit, in accordance with section 01 33 00 Submittal Procedures, documentation for review that includes, without limitation, the following:

- 1. Submit copies of licenses and registrations required including subcontractor's licenses.
- 2. Submit copies of written notification to the regulatory agencies with jurisdiction over this type of work (i.e. Division of Occupational Safety and Health, Department of Public Health, Air Quality management District, etc.):
- 3. Submit proof of insurance coverage required including proof of insurance for subcontractors.
- 4. Submit proof of legal right to use patented equipment or processes (if applicable).
- 5. Manufacturer's certification that HEPA vacuums, differential pressure air filtration devices and other local exhaust ventilation equipment conform to ANSI Z9.2 79.
- 6. Site specific work plan detailing paint film stabilization, paint related removal methods and asbestos abatement removal procedures to be utilized and measures to prevent the release of hazardous materials to soil, water, air, and other environmental media.
- 7. Submit full manufacturers' product data and safety data sheet for all chemical products to be used on site.
- 8. Submit documentation that CONTRACTOR'S employees performing paint film stabilization, removal, disposal, and air sampling operations have received training in accordance with applicable regulations.
- 9. Submit documentation that CONTRACTOR'S employees performing asbestos related removal, disposal, and air sampling operations have received training in accordance with applicable regulations.

10. Submit documentation from physician that all employees or agents who may be exposed to regulated or hazardous materials in excess of background levels have received medical surveillance in accordance with applicable regulations to determine whether they are physically capable of working while wearing the respirator required without suffering adverse health effects. The CONTRACTOR must be aware of and provide information to the examining physician about unusual conditions in the workplace environment (e.g. high temperatures, humidity, chemical contaminants) that may impact on the employee's ability to perform work activities.
11. Submit documentation from a physician that all employees or agents who may be exposed to lead contaminated dust have received a comprehensive medical examination as required by applicable regulations. In addition, the CONTRACTOR is to provide Blood Lead Tests on each employee within a two-week period prior to the commencement of said work and within a two-week period of the completion of this project.
12. Submit documentation of respirator fit testing for all CONTRACTOR employees and agents who must enter the Work Area. This fit testing must be in accordance with qualitative procedures as required by applicable worker safety regulations or be qualitative in nature and conducted at least annually.
13. Name and contact information of independent testing company who will challenge test all vacuums and air filtration devices used on this project.
14. Name and contact information for CONTRACTOR'S independent consultant that will conduct work plan preparation, project monitoring and clearance testing ensuring a clean work area upon completion of regulated and hazardous removal activities.
15. Name and contact information for laboratory who will analyze air samples or waste samples and documentation of their certification to conduct such analysis.
16. Name of Waste Transporter who will transport hazardous and non-hazardous waste on this project and documentation that the Transporter is allowed to transport such waste.
17. Name of Waste Landfill to which all waste will be sent and documentation that such landfill is allowed to accept such waste.
18. Emergency Precautions and Procedures to include, but not be limited to the following:
 - a. Establish emergency and fire exits from the Work Area.
 - b. As necessary but prior to commencement of work, notify local medical emergency personnel, both ambulance crews and hospital emergency room staff, of the abatement operations as to the possibility of having to handle contaminated or injured workers.
 - c. A plan to administer first aid to injured personnel after decontamination. When an injury occurs, the CONTRACTOR must stop Work and implement fiber reduction techniques (e.g., water spraying) until the injured person has been removed from the Work Area.

- d. Before starting actual removal of regulated or hazardous materials, it is customary to notify local police and fire departments as to the danger of entering the Work Area. It would be prudent to invite representatives of these departments to attend an informal training program to be conducted by the CONTRACTOR. The training program should include information regarding abatement activities, decontamination practices, etc. The CONTRACTOR should make every effort to help these agencies form plans of action should their personnel need to enter a contaminated area.

PART 2 - products

2.01 SUMMARY

- A. Deliver all consumable materials in the original packages, containers or bundles bearing the name of the manufacturer and brand name (where applicable).
- B. All poly shall be flame-retardant regardless of its designated use on this project.
- C. Disposal bags shall be constructed of 6 mil poly with labels required by OSHA, CDPH, Toxic Substance Control regulations.

PART 3 - execution

3.01 SUMMARY

- A. CONTRACTORS and subcontractors conducting regulated and/or hazardous material related construction work will be evaluated on a performance standard which includes, but is not limited to, cleanliness of work area, work practices as verified by exposure monitoring, containment set up, and ultimately, the clean-up of dust, and debris.
- B. Any work practice that creates regulated or hazardous material debris must be conducted within a regulated area as defined in applicable regulations and within a containment designed to control the emission of such materials.
- C. The containment system shall be designed and constructed to prevent visible dust or debris from migrating out of the work area as well as the escape of airborne lead or asbestos at or above regulatory levels (generally clearance levels for asbestos and action levels for lead). Should dust or debris generated by the work be found outside the containment, or the airborne concentrations outside the containment exceed background levels, the CONTRACTOR'S containment is inadequate. The CONTRACTOR and/or subcontractors will be required to redesign the containment to be more effective.

3.02 Submittals during work

- A. CONTRACTOR must proactively coordinate the signing of all waste manifests by the OWNER as to not cause any delay to the project schedule.
- B. During stabilization and/or abatement activities, CONTRACTOR must submit to the OWNER or OWNER's representative documentation that includes, without limitation, the following:
 - 1. Submit copies of the Work Area entry/exit logbook. Logbook must record name, affiliation, time in, and time out for each entry into the Work Area.
 - 2. Submit copies of logs documenting filter changes on respirators, HEPA vacuums, water filtration device, and other engineering controls.
 - 3. Submit copies of Material Safety Data Sheets (MSDS) for solvents, encapsulants, wetting agents and replacement materials, as necessary.
 - 4. Submit and post on site (within 48 hours) results of all required OSHA air monitoring.
 - 5. Submit copies of all accident/incident reports where injury or damage has occurred on or to OWNER's property.
 - 6. Manometer graphs identifying project name, date, and location.
 - 7. Submit copies any notification changes or amendments as necessary.

3.03 Post abatement submittals

- A. CONTRACTOR shall provide the following post-construction submittals to Owner within thirty (30) days of the completion of asbestos abatement work.
 - 1. Copies of revised notifications to regulatory agencies.
 - 2. Information on all new workers not covered by the pre-construction submittals and not submitted during the project.
 - 3. A copy of worker exposure monitoring results collected in compliance with DOSH regulations including daily/representative/full-shift/ breathing-zone air samples, and 30-minute excursion samples.
 - 4. A copy of the worker/visitor log showing the following for all persons entering the work area: date, name, social security number, entering, and leaving times, company or agency represented, and reason for entry. The CONTRACTOR'S time records will not be accepted in lieu of a worker/visitor log.
 - 5. Copies of all accident reports submitted during the course of work. If no accidents occur during the project this should be stated in writing by the CONTRACTOR.
 - 6. Receipts from the landfill operator acknowledging the CONTRACTOR'S delivery of wastes, including dates, container types and quantities, tare weights or material delivered, and all appropriate signatures.
 - 7. A complete record of the air filtration devices used certifying DOP testing (if performed) and a circular chart recording, indicating continuous operation and documenting differential air pressure.
 - 8. Copies of DOP Testing Performed on HEPA Equipment not Previously Submitted
 - 9. Manometer graphs identifying project name, date, and location.

10. A copy of the waste record showing dates, times, manifest numbers, quantities of wastes, types of containers removed from the work area, the hauler, and the signature of the recorder.
11. Completed Uniform Hazardous Waste forms.
12. Other Documents as Requested

3.04 monitoring

- A. OWNER reserves the right to perform air and performance monitoring at any time.

3.05 Clearance Air monitoring

A. Asbestos

1. OWNER may retain the services of a Certified Asbestos Consultant (CAC) or Certified Site Surveillance Technician (CSST) working under the direct supervision of a CAC. The CAC or CSST performs pre-start visual inspections, final visual inspections, contractor oversight activities, area air monitoring, personal air monitoring, clearance air monitoring.
2. The number, type and analytical method for asbestos samples will be communicated in the pre-project submittal document.
3. Clearance criteria for asbestos related work shall be those established by the EPA under the AHERA (40 CFR 763).

B. Lead

1. OWNER may retain the services of a California Department of Public Health Certified Inspector/Risk Assessor and/or Project Monitor. The role of the CDPH certified person performs pre-start visual inspections, final visual inspections, contractor oversight activities, personal air monitoring, as well as area air monitoring and clearance sampling as applicable.
2. The number, type and analytical method for lead samples will be communicated in the pre-project submittal document.
3. Clearance criteria for lead related work shall be those promulgated by the State of California, Department of Public Health.

C. END OF SECTION 02 82 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 2. Shelf angles.
 - 3. Steel bollards permanently set with anchored base plates.
 - 4. Steel bollards permanently set in concrete footings.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Anchor bolts indicated to be cast into concrete or built into unit masonry.

1.03 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.04 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Paint products.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel framing and supports for applications where framing and supports are not specified in other Sections.
2. Shelf angles.
3. Steel bollards permanently set with anchored base plates.
4. Steel bollards permanently set in concrete footings.
5. Anchor bolts indicated to be cast into concrete or built into unit masonry.

1.05 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
- D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- E. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- F. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- G. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- H. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- I. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 1. Size of Channels: As indicated.
 2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B, with G90 coating; 0.108-inch nominal thickness.
 3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B; 0.0966-inch minimum thickness; hot-dip galvanized after fabrication.
- J. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

- K. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- L. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- M. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- N. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- O. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).
- P. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).
- Q. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.
- R. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.02 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.
 - 3. Provide stainless-steel fasteners for fastening nickel silver.
 - 4. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Steel Bolts and Nuts (Weathering): Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.
- E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

- F. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
- G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.03 MISCELLANEOUS MATERIALS

- A. Anti-Corrosive Shop Primer: Either of following, compatible with finish paints specified to be used over it; use primer containing pigments that make it easily distinguishable from zinc-rich primer:
 - 1. Anti-Corrosive Alkyd Primer for Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 2. Rust-Inhibitive, Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- B. Zinc-Rich Primer: Either of following, compatible with finish paints specified to be used over it:
 - 1. Organic Zinc-Rich Primer: Solvent based, one component, anti-corrosive primer for complying the MPI#18.
 - 2. Inorganic Zinc-Rich Primer: Inorganic based, anti-corrosive primer complying the MPI#19.
 - 3. Epoxy Zinc-Rich Primer: Solvent based, two or three component, epoxy type complying with MPI#20.
- C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.04 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.05 STEEL FRAMING AND SUPPORTS FOR APPLICATIONS WHERE FRAMING AND SUPPORTS NOT SPECIFIED IN OTHER SECTIONS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Shop Finish:
 - 1. For Interior Dry Environment Locations: Anti-corrosive primer.
 - 2. Exception: Primer not required where framing is completely concealed in interior wall or ceiling construction.

2.06 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.07 STEEL BOLLARDS PERMANENTLY SET WITH ANCHORED BASE PLATES

- A. Fabricate metal bollards from Schedule 40 steel pipe.
 - 1. Cap bollards with 1/4-inch- thick steel plate.
 - 2. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.

3. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.
- B. Fabricate bollards with 3/8-inch- thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.
 1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.
- C. Shop Finish:
 1. Anti-corrosive primer.

2.08 STEEL BOLLARDS, PERMANENTLY SET IN CONCRETE FOOTINGS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
 1. Cap bollards with 1/4-inch- thick steel plate.
 2. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
 3. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.
- B. Shop Finish:
 1. Galvanized.

2.09 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.10 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean items of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Items Indicated to Receive Anti-Corrosive Shop Primer: SSPC-SP 3, "Power Tool Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Section 09 96 00 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.11 ALUMINUM FINISHES

- A. As-Fabricated Finish: AA-M12.
- B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
1. Cast Aluminum: Heavy coat of bituminous paint.
 2. Extruded Aluminum: Two coats of clear lacquer.
- 3.02 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS
- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- 3.03 INSTALLING METAL BOLLARDS PERMANENTLY SET USING ANCHORED BASE PLATES
- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
- B. Anchor bollards to existing construction with expansion anchors . Provide four 3/4-inch bolts at each bollard unless otherwise indicated.
1. Embed anchor bolts at least 4 inches in concrete.
- C. Fill bollards solidly with concrete, mounding top surface to shed water.
1. Do not fill removable bollards with concrete.
- 3.04 INSTALLING METAL BOLLARDS PERMANENTLY SET IN CONCRETE FOOTINGS
- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
1. Do not fill removable bollards with concrete.

- B. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- C. Fill bollards solidly with concrete, mounding top surface to shed water.
 - 1. Do not fill removable bollards with concrete.

3.05 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 "Exterior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 50 00

SECTION 05 53 13 - BAR GRATINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes:
 - 1. Welded steel bar gratings.
 - 2. Metal frames and supports for gratings.

1.03 COORDINATION

- A. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.04 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Clips and anchorage devices for gratings.
- B. Shop Drawings: Include plans, sections, details, and attachments to other work.

1.05 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Alabama Metal Industries Corporation, a Gibraltar Industries company.
 2. All American Grating.
 3. BarnettBates Corporation.
 4. Fisher & Ludlow.
 5. Grating Pacific, Inc.
 6. Grupo Metelmex, S.A. de C.V.
 7. Harsco Industrial IKG, a division of Harsco Corporation.
 8. MLP Steel Company; Laurel Steel Products Division.

2.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Sidewalks and Vehicular Driveways, Subject to Trucking: Uniform load of 250 lbf/sq. ft. or concentrated load of 8000 lbf, whichever produces the greater stress.
 2. Limit deflection to L/360 or 1/4 inch, whichever is less.

2.03 METAL BAR GRATINGS

- A. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual" or NAAMM MBG 532, "Heavy-Duty Metal Bar Grating Manual" as applicable.
- B. Welded Steel Grating :
1. Bearing Bar Spacing: 7/16 or 1/2 inch o.c.
 2. Bearing Bar Depth: As required to comply with structural performance requirements.
 3. Bearing Bar Thickness: As required to comply with structural performance requirements.
 4. Crossbar Spacing: 4 inches o.c.
 5. Traffic Surface: Plain.
 6. Steel Finish:
 - a. Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. of coated surface.

2.04 STEEL

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Bars for Bar Gratings: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 33, with G90 coating.

2.05 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563 and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.
- D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Post-Installed Anchors: Torque-controlled expansion or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.06 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

2.07 FABRICATION

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Welding: Comply with AWS recommendations 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. Remove welding flux immediately.
- F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
- G. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
 - 1. Clips/Anchors for Gratings:
 - a. Weld Lugs: Provide no fewer than four weld lugs for each grating section containing rectangular bearing bars 3/16 inch or less in thickness and spaced less than 15/16 inch o.c., with each lug shop welded to three or more bearing bars. Interrupt intermediate bearing bars as necessary for fasteners securing grating to supports.
- H. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
 - 1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
- I. Do not notch bearing bars at supports to maintain elevation.

2.08 GRATING FRAMES AND SUPPORTS

- A. Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
 - 1. Unless otherwise indicated, fabricate from same basic metal as gratings.
 - 2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of metal straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.

2.09 STEEL FINISHES

- A. Galvanizing:
 - 1. Galvanize gratings, frames, and supports after assembly.
 - 2. Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.
 - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Field Welding: Comply with AWS recommendations 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. Remove welding flux immediately.

3.02 INSTALLING METAL BAR GRATINGS

- A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips/anchors and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
- C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by clipping/anchoring as indicated above.

3.03 ADJUSTING AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 53 13

SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:

1. Rooftop equipment bases and support curbs - architectural work.
2. Rooftop equipment bases and support curbs - utility work.
3. Wood blocking - utility work.
4. Equipment backing panels, interior exposure - architectural work.
5. Equipment backing panels, interior exposure - utility work.
6. Wood-preservative treatment (WPT).
7. Fire-retardant treatment (FRT).
8. Fasteners.
9. Metal framing anchors.
10. Separator sheeting.

1.03 REFERENCES

- A. Acronyms:

1. NeLMA - Northeastern Lumber Manufacturers Association.
2. SPIB - the Southern Pine Inspection Bureau.
3. WCLIB - West Coast Lumber Inspection Bureau.

- B. Definitions:

1. Applications:
 - a. Architectural Work: Applications for carpentry work requiring a greater degree of precision, less warp, less bow, fewer knots and other defects which may affect finish tolerances and other performance of the Work.
 - b. Utility Work: Applications for carpentry where economy is of greater importance than precision and performance of the Work; temporary rough carpentry.
2. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

3. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.
4. Blocking: Wood material typically concealed in other construction used to secure, join, or reinforce members, or to fill spaces between them, or to attach other construction such as fixtures, accessories, casework, and other materials.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. For Wood-Preservative Treated Materials:

- a. Include data for from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
- b. For materials receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

2. For Fire-Retardant Treated Materials:

- a. Include data from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
- b. Include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
- c. For materials receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.05 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Metal framing anchors.

1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

- A. Named Wood Species: Lumber species named in this Section may be known by other names (e.g. Idaho white pine may also be known as Western white pine or White pine). Provide named species or same species as known by another name that can be verified in an authoritative reference such as "The Encyclopedia of Wood", Sterling Publishing Co., Inc.
- B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
 - a. If acceptable with Authorities having Jurisdiction, markings may be omitted if certificates of grade compliance issued by grading agency are submitted.
 - 3. Dress lumber, S4S, unless otherwise indicated.
- C. Maximum Moisture Content of Lumber:
 - 1. 19 percent.

2.02 WOOD-PRESERVATIVE-TREATED (WPT) MATERIALS

- A. Preservative Treatment by Pressure Process:
 - 1. AWPAC Use Category:
 - a. U1 - Interior Dry: For interior construction above and not in contact with ground, dry service conditions.
 - b. UC2 - Interior Damp: For interior construction above and not in contact with ground, damp service conditions.

- c. UC3B - Above Ground Exposed: For exterior construction above and not in contact with ground, uncoated or poor water run-off service conditions.
 - d. UC4A - Ground Contact General Use: For construction in contact with ground or fresh water, non-critical components service conditions.
 - e. _.
 - 2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - a. Do not use inorganic boron (SBX) for sill plates.
 - 3. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
 - B. Lumber: Kiln-dry after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
 - C. Plywood: Kiln-dry after treatment to a maximum moisture content of 15 percent.
 - D. Mark lumber and plywood with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - 1. For exposed lumber and plywood indicated to receive a stained or natural finish, mark end or back of each piece.
 - a. If acceptable with Authorities having Jurisdiction, markings may be omitted if certificates of treatment compliance issued by inspection agency are submitted.
 - E. Application: Treat items indicated on Drawings, and the following:
 - 1. Rooftop equipment bases and support curbs: Where connecting with roofing, flashing, vapor barriers, and waterproofing; where in contact with masonry or concrete.
 - 2. Wood blocking: Where connecting with roofing, flashing, vapor barriers, and waterproofing; where in contact with masonry or concrete.
- 2.03 FIRE-RETARDANT-TREATED (FRT) MATERIALS
- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Treatment shall not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing, framing in attic spaces, and where high-temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.
- C. Lumber: Kiln-dry after treatment to a maximum moisture content of 19 percent.
- D. Plywood: Kiln-dry after treatment to a maximum moisture content of 15 percent.
- E. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
 - 1. For exposed lumber or plywood indicated to receive a stained or natural finish, mark end or back of each piece.
 - a. If acceptable with Authorities having Jurisdiction, markings may be omitted if certificates of treatment compliance issued by inspection agency are submitted.
- F. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.
- G. Application: Treat items indicated on Drawings, and the following:
 - 1. Equipment backing panels, interior exposure.

2.04 MISCELLANEOUS LUMBER

- A. General: Provide the following miscellaneous lumber where indicated and lumber for support or attachment of other construction.
- B. Rooftop equipment bases and support curbs - architectural work:

1. Dimension Lumber:
 - a. Grade: No. 2, Construction, or better.
 - b. Species: Any of following:
 - 1) NeLMA; Spruce-pine-fir (south), or other eastern softwood.
 - 2) SPIB; Mixed southern pine or southern pine.
 - 3) WCLIB; Hem-fir, Spruce-pine-fir (south), or other western wood.
 - c. Provide wood-preservative-treated (WPT) lumber where indicated.
2. Equipment Base Top Panels: Plywood, DOC PS 1, Exterior Exposure, Grade C-C Plugged or better.
 - a. Nominal Thickness: Not less than following unless indicated otherwise on Drawings:
 - 1) 1/2 inch where minor span of support framing is 32 inches or less.
 - 2) 3/4 inch where minor span of support framing exceeds 32 inches.

C. Rooftop equipment bases and support curbs - utility work:

1. Dimension Lumber:
 - a. Grade: Stud, No. 3, Standard, or better.
 - b. Species: Any of following:
 - 1) NeLMA; Spruce-pine-fir (south), or other eastern softwood.
 - 2) SPIB; Mixed southern pine or southern pine.
 - 3) WCLIB; Hem-fir, Spruce-pine-fir (south), or other western wood.
 - c. Provide wood-preservative-treated (WPT) lumber where indicated.
2. Equipment Base Top Panels: Plywood, DOC PS 1, Exterior Exposure, Grade C-C Plugged or better.
 - a. Nominal Thickness: Not less than following unless indicated otherwise on Drawings:
 - 1) 1/2 inch where minor span of support framing is 32 inches or less.
 - 2) 3/4 inch where minor span of support framing exceeds 32 inches.

D. Blocking - utility work:

1. General:
 - a. Where used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

- b. Where not used for attachment of other construction, Stud, No. 3, Standard, or Utility grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- 2. Dimension Lumber:
 - a. Grade: Stud, No. 3, Standard, or better.
 - b. Species: Any of following:
 - 1) NeLMA; Spruce-pine-fir (south), or other eastern softwood.
 - 2) SPIB; Mixed southern pine or southern pine.
 - 3) WCLIB; Hem-fir, Spruce-pine-fir (south), or other western wood.
 - c. Provide wood-preservative-treated (WPT) lumber where indicated.
- 3. Plywood: Limit use only for attaching other construction such as fixtures, accessories, casework, and other materials.
 - a. DOC PS 1, Exposure 1, Grade C-D Plugged or better.
 - b. Nominal Thickness:
 - 1) Not less than 1/2 inch unless indicated otherwise.
 - 2) As indicated on Drawings.
 - 3) Not less than 3/4 inch where used to support railings, handrails, grab bars, seating, and similar conditions.

2.05 PLYWOOD BACKING PANELS

- A. Equipment backing panels, interior exposure - architectural work:
 - 1. Plywood, DOC PS 1, Exposure 1, Grade A-C.
 - a. Nominal Thickness: Not less than 3/4 inch unless indicated otherwise on Drawings.
 - b. Provide fire-retardant-treated (FRT) plywood where indicated.
- B. Equipment backing panels, interior exposure - utility work:
 - 1. Plywood, DOC PS 1, Exposure 1, Grade C-D Plugged.
 - a. Nominal Thickness: Not less than 3/4 inch unless indicated otherwise on Drawings.
 - b. Provide fire-retardant-treated (FRT) plywood where indicated.

2.06 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Provide fasteners either with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel for the following work:
 - a. Carpentry exposed to weather.
 - b. Carpentry in areas of high relative humidity.
 - c. Interior carpentry wood-preservative treated (WPT).
 - d. Carpentry fire-resistive-treated (FRT).
2. Provide only Type 304 stainless steel fasteners for the following work:
 - a. Exterior carpentry wood-preservative treated (WPT).
 - b. Carpentry is in contact with ground.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Wood Screws: ASME B18.6.1.

D. Screws for Fastening to Metal Framing: Length as recommended by screw manufacturer for material being fastened and complying with the following for metal thickness fastened to:

1. ASTM C 1002 for following metal thicknesses:
 - a. 18 mil (25 gage).
 - b. 27 mil (22 gage).
 - c. 30 mil (20 gage drywall).
2. ASTM C 954 for following metal thicknesses:
 - a. 33 mil (20 gage structural).
 - b. 43 mil (18 gage).
 - c. 54 mil (16 gage).
 - d. 68 mil (14 gage).

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

2.07 METAL FRAMING ANCHORS

A. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

2.08 MISCELLANEOUS MATERIALS

- A. Separator Sheeting: Flexible flashing composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
 - 1. Do not use butyl rubber sheeting over substrates containing asphaltic compounds.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate supports to comply with requirements for attaching other construction.
- C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- D. Do not splice structural members between supports unless otherwise indicated.
- E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- F. Comply with AWWA M4 for applying field treatment to cut surfaces of wood preservative-treated (WPT) lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- G. Where wood-preservative-treated (WPT) lumber is installed on metal substrates, install continuous flexible flashing separator between wood and metal substrate.
- H. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 2. ICC-ES evaluation report for fastener.

- I. Fastening to Wood: Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
- J. Fastening to Metal: Use screw type fasteners unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Do not countersink screw heads unless otherwise indicated.
- K. Bolt and Nut Fastening: Where indicated, bolt and nut fasten carpentry work. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.02 ROOFTOP EQUIPMENT BASES AND SUPPORT CURBS INSTALLATION

- A. Anchor bases and curbs securely in place so they are capable of resisting indicated loads.
- B. Install equipment support bases so that top surfaces are level with each other and extend not less than 8 inches above finished surface of roofing.
- C. Install equipment support curbs so top surface is level and extends not less than 8 inches above finished surface of roofing.

3.03 WOOD BLOCKING INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading.

3.04 PLYWOOD BACKING PANEL INSTALLATION

- A. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.
- B. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- C. Fasten panels to studs to support applied loading.
 - 1. Screw to metal stud wall framing not less than 12 inches o.c. vertically at each stud.

3.05 PROTECTION

- A. WPT Wood: Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 53

SECTION 06 41 69 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes plastic-laminate countertops.

1.03 REFERENCES

- A. Acronyms:
 - 1. AWS - Architectural Woodwork Standards and its joint adoptees and publishers including:
 - a. WI - Woodwork Institute.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show locations and sizes of cutouts and holes for plumbing fixtures faucets electrical switches and outlets and other items installed in plastic-laminate countertops.
- C. Samples for Verification:
 - 1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with one sample applied to core material.
 - 2. Wood-grain plastic laminates, 12 by 24 inches, for each type, pattern and surface finish, with one sample applied to core material.

1.05 INFORMATIONAL SUBMITTALS

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

1. Composite wood and agrifiber products.
2. High-pressure decorative laminate.
3. Adhesives.

1.06 QUALITY ASSURANCE

A. Fabricator and Installer Qualifications:

1. Fabrication shop and installer that employs skilled workers who custom fabricate and install products similar to those required for this Project and whose products have a record of successful in-service performance. Fabrication shop and installer need not be the same unless indicated otherwise below.

1.07 DELIVERY, STORAGE, AND HANDLING

- ##### A.
- Do not deliver countertops until painting and similar operations that could damage countertops have been completed in installation areas. If countertops must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.08 FIELD CONDITIONS

- ##### A.
- Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- ##### B.
- Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.01 PLASTIC-LAMINATE COUNTERTOPS, GENERAL

- ##### A.
- Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, installation, and other requirements.
1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

2.02 PLASTIC-LAMINATE COUNTERTOPS

- A. Grade: Custom.
- B. High-Pressure Decorative Laminate:
 - 1. NEMA LD 3, Grade as follows:
 - a. Grade HGL (0.039 inch or 1.0 mm thick) for flat surface countertops unless indicated otherwise.
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide:
 - a. Product indicated on Drawings.
 - b. Or comparable product by one of the following:
 - 1) Abet Laminati, Inc.
 - 2) Formica Corporation.
 - 3) Lamin-Art, Inc.
 - 4) Panolam Industries International, Inc.
 - 5) Wilsonart International; Div. of Premark International, Inc.
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As indicated by manufacturer's designations as indicated on Drawing's Finish Legend.
 - 2. Grain Direction: Parallel to cabinet fronts.
- D. Edge Treatment: Same as laminate cladding on horizontal surfaces.
- E. Core Material, Counters with Dry Exposures:
 - 1. Particleboard.
- F. Core Material, Counters with Wet Exposures (e.g. at sinks):
 - 1. Particleboard made with exterior glue.
- G. Core Thickness: 3/4 inch.

2.03 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.
 - 1. Wood Moisture Content: 5 to 10 4 to 9 percent.

B. Composite Wood and Agrifiber Products:

1. Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
2. Particleboard: ANSI A208.1, Grade M-2; and made with exterior glue where indicated.

2.04 MISCELLANEOUS MATERIALS

A. Shop Applied Adhesives:

1. Adhesive for Bonding Plastic Laminate:
 - a. For the following uses:
 - 1) General Use: Unpigmented contact cement, contact cement, PVA, or resorcinol.
2. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.05 FABRICATION

- A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:
1. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
- B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.
- B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.02 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
 2. Seal edges of cutouts by saturating with varnish.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
 1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
- D. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 2. Secure backsplashes and sidesplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.

3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.03 ADJUSTING AND CLEANING

- A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean countertops on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 41 69

SECTION 07 16 16 - CRYSTALLINE WATERPROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes crystalline waterproofing.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and installation instructions.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Applicator.
- B. Product Certificates: For each type of waterproofing, patching, and plugging material.
- C. Product Test Reports: For each product formulation, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.06 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm experienced in applying crystalline waterproofing similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and that employs workers trained and approved by manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup of typical vertical and horizontal surfaces 10 sq. ft. in size.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit crystalline waterproofing to be performed according to manufacturer's written instructions.
- B. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.
- C. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F or above during work and cure period, and space is well ventilated and kept free of water.

PART 2 - PRODUCTS

2.01 WATERPROOFING MATERIALS

- A. Crystalline Waterproofing: Prepackaged, gray -colored proprietary blend of portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates into concrete and concrete unit masonry and reacts chemically with the byproducts of cement hydration in the presence of water to develop crystalline growth within substrate capillaries to produce an impervious, dense, waterproof substrate; with properties complying with or exceeding the criteria specified below.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems; Tegraproof.
 - b. ICS Penetron International Ltd.; Penetron.
 - c. International Chem-Crete, Inc.; Chem-Cretex Cem 600.
 - d. Tremco Incorporated, an RPM company; Permaquik Crystalline Waterproofing.
 - e. Xypex Chemical Corporation; Xypex Concentrate with Xypex Modified.
 2. Water Permeability: Maximum zero for water at 30 feet when tested according to COE CRD-C 48.
 3. Compressive Strength: Minimum 4000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.02 ACCESSORY MATERIALS

- A. Patching Compound: Factory-premixed cementitious repair mortar, crack filler, or sealant recommended by waterproofing manufacturer for filling and patching tie holes, honeycombs, reveals, and other imperfections; and compatible with substrate and other materials indicated.
- B. Plugging Compound: Factory-premixed cementitious compound with hydrophobic properties and recommended by waterproofing manufacturer; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead, and horizontal surfaces not exposed to vehicular traffic); and compatible with substrate and other materials indicated.
- C. Water: Potable.

2.03 MIXES

- A. Crystalline Waterproofing: Add prepackaged dry ingredients to water according to manufacturer's written instructions. Mix together with mechanical mixer or by hand to required consistency.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for suitable conditions where waterproofing is to be applied.
- B. Proceed with application only after unsatisfactory conditions have been corrected.
- C. Notify Architect in writing of active leaks or defects that would affect system performance.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions.
- B. Protect other work from damage caused by cleaning, preparation, and application of waterproofing. Provide temporary enclosure to confine spraying operation and to ensure adequate ambient temperatures and ventilation conditions for application.
- C. Do not allow waterproofing, patching, and plugging materials to enter reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves.
- D. Stop active water leaks with plugging compound.

- E. Repair damaged or unsatisfactory substrate with patching compound.
 - 1. At holes and cracks 1/16 inch wide or larger in substrate, remove loosened chips and cut reveal with sides perpendicular to surface, not tapered, and minimum 1 inch deep. Fill reveal with patching compound flush with surface.
- F. Surface Preparation: Remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, paint, curing compounds, and form-release agents to ensure that waterproofing bonds to surfaces.
 - 1. Clean concrete surfaces according to ASTM D 4258.
 - a. Smooth-Formed and Trowel-Finished Concrete: Prepare by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.
 - 2. Concrete Joints: Clean reveals.

3.03 APPLICATION

- A. General: Comply with waterproofing manufacturer's written instructions for application and curing.
 - 1. Saturate surface with water for several hours and maintain damp condition until applying waterproofing. Remove standing water.
 - 2. Apply waterproofing to surfaces, and extend waterproofing onto adjacent surfaces as follows:
 - a. Onto columns integral with treated walls.
 - b. Onto interior nontreated walls intersecting exterior treated walls, for a distance of 24 inches for cast-in-place concrete.
 - c. Onto exterior walls and onto both exterior and interior columns, for a height of 12 inches, where floors, but not walls, are treated.
 - d. Onto every substrate in areas indicated for treatment, including pits, sumps, and similar offsets and features.
 - 3. Number of Coats: Number required for specified water permeability .
 - 4. Application Method: Apply to ensure that each coat fills voids and is in full contact with substrate or previous coat.
 - 5. Dampen surface between coats.
- B. Final Coat Finish: Smooth.
- C. Curing: Moist-cure waterproofing for three days immediately after final coat has set, followed by air drying, unless otherwise recommended in writing by manufacturer.

END OF SECTION 07 16 16

SECTION 07 54 23 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Thermoplastic polyolefin (TPO) roofing system of following types:
 - a. Fully adhered TPO roofing system.
 - 1) Roof Type: TPO sheet on substrate board on structural metal roof deck, all fully adhered.
2. Components including, but not limited to, the following:
 - a. TPO sheet.
 - b. Electrically conductive medium required for leakage testing using electrical conductance measurement method.
 - c. Substrate board.

B. Related Requirements:

1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
2. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
3. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.03 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Construction Manager, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.
10. Review methods and procedures related to roofing leakage testing.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. For insulation and roof system component fasteners, include copy of listing from the following:
 - a. FM Approvals' RoofNav.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:
 1. Layout and thickness of insulation.
 2. Base flashings and membrane terminations.
 3. Flashing details at penetrations.
 4. For sloped structural deck, indicate slopes of top of TPO sheet, including crickets.
 5. Tie-in to adjoining air barrier.
- C. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For the following:

1. Manufacturer.
2. Installer.

B. Manufacturer Certificates:

1. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

C. Product Test Reports: For the following, for tests performed by an independent qualified testing agency, indicating compliance with specified requirements:

1. Roof membrane.

D. Field quality-control reports.

E. Sample Warranties: For manufacturer's special warranties.

1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.08 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer is one having roofing systems identical to that used for this Project that are:

1. UL listed.
2. Listed in FM Approvals' RoofNav.

- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

- 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. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

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

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Warranty shall include the following:
 - a. Roofing membrane, sheet flashings, fasteners, and other auxiliary roofing materials.
 - b. Substrate board.
 - 2. Warranty Period: 20 years from date of Substantial Completion.
- B. Installer's Special Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section.
 - 1. Warranty shall include the following:
 - a. Roofing membrane, sheet flashings, fasteners, and other auxiliary roofing materials.
 - b. Substrate board.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain following components for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer:
 - 1. Sheet flashings, fasteners, and other auxiliary roofing materials.
 - 2. Substrate board.

2.02 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.
 - 1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
 - 2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- C. Wind Uplift - Resistance, Testing, and Design:
 - 1. Design roofing system to resist the design wind speed and uplift pressures indicated on Structural Drawings .
 - 2. Non-Ballasted Roofing: Systems shall be tested according to FM Approvals 4474, UL 580, or UL 1897.
 - a. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
 - 1) FM Fire Classification: Class 1A.
 - 2) Systems shall be designed in accordance with FM Global Property Loss Prevention Data Sheets.
- D. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

2.03 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

- A. Fabric-Reinforced and Fabric-Backed TPO Sheet: ASTM D 6878, internally fabric- or scrim-reinforced, uniform, flexible fabric-backed TPO sheet.
 - 1. Thickness (exclusive of nominal 55 mil fabric backing): 60 mils nominal.
 - 2. Exposed Face Color: White.
 - 3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Carlisle SynTec Incorporated.
- b. Firestone Building Products.
- c. Flex Membrane International Corp.
- d. GAF.
- e. Johns Manville; a Berkshire Hathaway company.

2.04 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
 - 1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction..
- B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 milsthick, minimum, of same color as TPO sheet.
- C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
- D. Roof Vents: As recommended by roof membrane manufacturer.
 - 1. Size: Not less than 4-inch (100 mm) diameter.
- E. Bonding Adhesive: Manufacturer's standard. Provide water based formulation if Project or authorities having jurisdiction require compliance with VOC emissions limitations.
- F. Slip Sheet: Provide manufacturer's standard if required for conditions indicated, of thickness required for application.
- G. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- H. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
- I. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.
- J. Electrically Conductive Medium: Required for leakage testing using electrical conductance measurement method; conductive material of type suitable for application to substrate directly beneath roofing membrane, including but not limited to the following:
 - 1. Conductive Primer: Products include, but are not limited to, IntegriScan; TruGround Conductive Primer.
 - 2. Welded Stainless Steel Mesh: Products include, but are not limited to, International Leak Detection; Vector Mapping Grid VMG.

3. Fine Aluminum Screen: Products include, but are not limited to, International Leak Detection; Vector Mapping Mesh VMM.
 4. Non-Abrasive Conductive Fabric: Products include, but are not limited to, International Leak Detection; Vector Mapping Felt VMF.
- K. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.05 SUBSTRATE BOARDS

A. Gypsum Core Substrate Board:

1. Provide either of the following:
 - a. ASTM C1177/C1177M, glass-mat, water-resistant gypsum board.
 - 1) Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a) CertainTeed Corporation; GlasRoc Roof Board.
 - b) Georgia-Pacific Gypsum LLC; Dens Deck Prime.
 - c) National Gypsum Company; DEXcell Glass Mat Roof Board.
 - d) National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing.
 - e) USG Corporation; USG Securock Brand Glass-Mat Roof Board.
 - b. ASTM C1278/C1278M, fiber-reinforced gypsum board.
 - 1) Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a) USG Corporation; Securock Gypsum-Fiber Roof Board.
2. Thickness: As indicated on Drawings, but not less than the following for applications indicated:
 - a. 1/2 inch thick; acceptable applications include:
 - 1) On non-fire-resistive rated roof assemblies only.
 - 2) On smooth decking with no flutes or ribs.
 - 3) On metal decking with span between flutes or ribs not more than 5 inches.
 - b. 5/8 inch thick, Type X; acceptable applications include:
 - 1) On fire-resistive rated roof assemblies as substrate board serving as thermal barrier.

- 2) On non-fire-resistive rated roof assemblies.
 - 3) On smooth decking with no flutes or ribs.
 - 4) On metal decking with span between flutes or ribs not more than 8 inches.
3. For substrate board receiving adhered vapor retarder or insulation board provide one of the following:
 - a. Substrate board with factory primed or other integral surface finish acceptable to membrane manufacturer for adhered installations.
 - b. Substrate board requiring field applied primer; provide primer acceptable to membrane manufacturer.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 3. Steel Roof Decks:
 - a. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 00 "Steel Decking."
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.03 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions.
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.

3.04 SUBSTRATE BOARD INSTALLATION

- A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

3.05 ADHERED ROOF MEMBRANE INSTALLATION

- A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
 - 1. Unroll roof membrane and allow to relax before installing.
- B. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- C. Membrane Adhesive Application:
 - 1. For Fabric-Backed Roof Membrane:
 - a. Hot Roofing Asphalt: Apply a solid mopping of hot roofing asphalt to substrate at temperature and rate required by manufacturer, and install fabric-backed roof membrane. Do not apply to splice area of roof membrane.
 - b. Fabric-Backed Roof Membrane Adhesive: Apply to substrate at rate required by manufacturer, and install fabric-backed roof membrane.
- D. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.
- E. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- F. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

3.06 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings. Mechanically anchor to substrate through termination bars at following locations:
 1. Where indicated on Drawings.
 2. Parapets and walls.

3.07 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Electrical Conductance Measurement Methods Testing: Perform the following:
 1. Testing agency shall survey entire roof area, flashings, and parapet walls to locate discontinuity in the roof membrane in accordance with one of the following conductance leak location testing methods as described in ASTM D7877:
 - a. Low-Voltage Electronic Scanning System Testing: According to ASTM D8231 using a scanning platform for horizontal surfaces and water moistened sensor for vertical surfaces.
 - b. Low-Voltage Electrical Field Vector Mapping (EFVM) Testing: Using an exposed metal electrical loop to create an electrical field tested with handheld probes.
 - c. High-Voltage Spark Testing: Using an electrically charged metal "broom head."

2. Verify that conductive medium has been applied to non-conductive substrate directly beneath roofing membrane (concrete and metal are only known conductive substrates that don't require a conductive primer when located directly beneath roofing membrane).
3. Perform tests before overlying construction is placed.
4. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
 - a. Cost of retesting is Contractor's responsibility.
5. Testing agency shall prepare survey report indicating locations of initial discontinuities, if any.

C. Flooding Method Testing: Perform the following:

1. Flood test each roof area for leaks, according to recommendations in ASTM D5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - a. Perform tests before overlying construction is placed.
 - b. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of base flashing.
 - c. Flood each area for 24 hours.
 - d. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - e. Testing agency shall prepare survey report indicating locations of initial leaks, if any, and final survey report.

- D. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
- E. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.08 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage of fluid-applied bonding materials from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.09 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

- 1. Owner: _____.
- 2. Owner's Address: _____.
- 3. Building Name/Type: _____.
- 4. Building Address: _____.
- 5. Area of Work: _____.
- 6. Acceptance Date: _____.
- 7. Warranty Period: _____ yrs.
- 8. Warranty Expiration Date: _____.

- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:

- 1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding _ mph;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and

- g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
 6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
 7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 07 54 23

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:

- 1. Formed roof-drainage sheet metal fabrications.
 - a. Parapet scuppers.
- 2. Formed low-slope roof sheet metal fabrications.
 - a. Copings.
- 3. Formed equipment support flashing.
- 4. Underlayment Materials:
 - a. Felt.
 - b. Synthetic underlayment.
 - c. Self-Adhering, high-temperature sheet.
 - d. Slip sheet.
- 5. Miscellaneous materials for sheet metal flashing and trim.

- B. Related Requirements:

- 1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
- 2. Section 07 54 23 "Thermoplastic Polyolefin (TPO) Roofing" for materials and installation of sheet metal flashing and trim integral with roofing.

1.03 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
 - 3. Review requirements for insurance and certificates if applicable.
 - 4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: For sheet metal flashing and trim.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
 - 3. Include identification of material, thickness, weight, and finish for each item and location in Project.
 - 4. Include details for forming, including profiles, shapes, seams, and dimensions.
 - 5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - 6. Include details of termination points and assemblies.
 - 7. Include details of special conditions.
 - 8. Include details of connections to adjoining work.
 - 9. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Verification: For each type of exposed finish.
 - 1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
 - 2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
 - 3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Certificates: For the following:
 - 1. Coping:
 - a. For each type that is FM Approvals approved.
- C. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- D. Sample Warranty: For special warranty.

1.07 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockup of following approximately 5 feet long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
 - a. Typical roof edge, including:
 - 1) Fascia.
 - 2) Fascia trim.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standards:
 - 1. For Copings: Comply with requirements indicated in the following publications for dimensions and profiles shown unless more stringent requirements are indicated.
 - a. NRCA's "The NRCA Roofing Manual."
 - b. SMACNA's "Architectural Sheet Metal Manual."
- C. FM Approvals Listing: Identify the following materials with name of fabricator and design approved by FM Approvals.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 - 1. Surface Texture:
 - a. Smooth, flat.
 - 2. Surface Finish or Coating:
 - a. Alclad Finish: Metallurgically bonded surfacing alloy on both sides, forming aluminum sheet with reflective luster.
 - b. Coil-Coated Paint Finishes:

- 1) Exposed Surface Finish:
 - a) Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2) Color: As selected by Architect from manufacturer's full range.
 - 3) Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed; with smooth, flat surface.
1. Finish: 2D (dull, cold rolled).
- D. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40.
1. Surface Texture:
 - a. Smooth, flat.
 2. Surface Finish or Coating:
 - a. Coil-Coated Paint Finishes: Metallic-coated steel sheet prepainted by coil-coating process to comply with ASTM A 755/A 755M.
 - 1) Exposed Surface Finish:
 - a) Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2) Exposed Surface Color: As selected by Architect from manufacturer's full range.
 - 3) Concealed Surface Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.03 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F; and complying with physical requirements of ASTM D 226/D 226M for Type I and Type II felts.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Atlas Roofing Corporation; Summit.
 - b. Engineered Coated Products; Nova-Seal II.
 - c. Kirsch Building Products, LLC; Sharkskin Ultra.
 - d. SDP Advanced Polymer Products Inc; Palisade.
- C. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Residential, a division of Carlisle Construction Materials; WIP 300HT.
 - b. Grace Construction Products; W. R. Grace & Co.-Conn.; Grace Ice and Water Shield HT.
 - c. Metal-Fab Manufacturing, LLC; MetShield.
 - d. Owens Corning; WeatherLock Specialty Tile & Metal Underlayment.
 - e. Polyguard Products, Inc.; Deck Guard HT.
 - 2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
 - 3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.
- D. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft.minimum.

2.04 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 4. Fasteners for Zinc-Coated (Galvanized) and Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.05 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 2. Obtain field measurements for accurate fit before shop fabrication.

3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
- G. Seams: Shop fabricate nonmoving seams with flat-lock seams and seal as follows:
1. Aluminum Sheet with Alclad Finish: Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.
 2. Aluminum Sheet with Exposed Coil-Coated (Painted) Finish: Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
 3. Stainless-Steel Sheet: Tin edges to be seamed, form seams, and solder.
 4. Metallic-Coated Steel Sheet:
 - a. With Coil-Coated Painted Finish: Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- H. Do not use graphite pencils to mark metal surfaces of the following:
1. Aluminum-zinc alloy-coated steel sheet.

2.06 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:
1. Aluminum: 0.032 inch thick.
 2. Galvanized Steel: 0.028 inch thick.
 3. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

2.07 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Copings: Fabricate in minimum 96-inch- long, but not exceeding 12-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.
1. Joint Style: Butted with expansion space and 6-inch- wide, concealed backup plate .
 2. Fabricate from the Following Materials:
 - a. Aluminum: 0.050 inch thick.
 - b. Galvanized Steel: 0.040 inch thick.
 - c. Aluminum-Zinc Alloy-Coated Steel: 0.040 inch thick.

2.08 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
1. Stainless Steel: 0.019 inch thick.
 2. Galvanized Steel: 0.028 inch thick.
 3. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
1. Verify compliance with requirements for installation tolerances of substrates.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 UNDERLAYMENT INSTALLATION

- A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.
- B. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, according to manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.
- C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.
- D. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

3.03 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 5. Torch cutting of sheet metal flashing and trim is not permitted.
 6. Do not use graphite pencils to mark metal surfaces of the following:
 - a. Aluminum-zinc alloy-coated steel sheet.

- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of flashing and trim fabricated from the following sheet metal(s) with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 - a. Aluminum sheet with alclad finish.
 - b. Stainless-steel sheet.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install following underlayment(s).
 - a. Felt covered by slip sheet.
 - b. Synthetic underlayment.
 - c. Self-Adhering, high-temperature sheet.
- C. Expansion Provisions:
1. Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
 - a. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 - b. Use lapped expansion joints only where indicated on Drawings. Apply sealant tape concealed in joint.
 2. Conceal where possible in exposed work.
 3. Locate to minimize possibility of leakage.
 4. Cover and seal anchors as required for a tight installation.
- D. Fasteners:
1. Size: Use fastener sizes that:
 - a. Penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
 - b. Penetrate other substrates not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
 2. Conceal where possible in exposed work.
 3. Locate to minimize possibility of leakage.
 4. Cover and seal as required for a tight installation.
- E. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

F. Rivets:

1. Where necessary for strenght, rivet field joints if riveting is permitted for shop fabricated joints.
2. Do not rivet soldered joints unless otherwise indicated.
3. Rivets heads exposed to veiw must closely match color of sheet metal finish.

3.04 ROOF-DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 1. Anchor scupper closure trim flange to exterior wall and solder or seal with elastomeric sealant to scupper.
 2. Loosely lock front edge of scupper with conductor head.
 3. Solder or seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.

3.05 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Copings:
 1. Anchor to resist uplift and outward forces according to recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.

3.06 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.07 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.08 CLEANING AND PROTECTION

- A. Clean the following exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
 - 1. Aluminum sheet with alclad finish.
 - 2. Stainless-steel sheet.
- B. Clean off excess sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 62 00

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:

- 1. The following joint sealant compositions:

- a. Silicone joint sealants.
 - b. Nonstaining silicone joint sealants.
 - c. Urethane joint sealants.
 - d. Silyl-terminated polyether joint sealants.
 - e. Mildew-resistant joint sealants.
 - f. Butyl joint sealants.
 - g. Latex joint sealants.

- 2. Joint sealant backings:

- a. Cylindrical backings.
 - b. Bond-breaker tape.

- 3. Miscellaneous materials including:

- a. Primers.
 - b. Cleaners.
 - c. Masking tape.

- B. Joint Sealant Schedule: Select joint sealant compositions from the following application schedules for each severity of use, substrate, and joint type. Where more than one sealant composition is listed, select the one best suited for the conditions indicated or encountered.

- 1. Exterior joints in horizontal traffic surfaces (not subject to water immersion):

- a. Cast-in-place concrete slabs:

- 1) Contraction control joints: JS-011, JS-012, JS-014, JS-016, JS-019, JS-021, JS-106, JS-109, JS-113, JS-114, JS-122, JS-124, JS-127, JS-129.
 - 2) Expansion joints: JS-011, JS-016, JS-021, JS-106.

- 3) Isolation joints: JS-011, JS-012, JS-016, JS-021, JS-106, JS-122, JS-127.
2. Exterior joints in vertical surfaces and horizontal nontraffic surfaces (not subject to water immersion), including ceilings, soffits and other overhead surfaces.
 - a. Cast-in-place concrete:
 - 1) Construction joints: JS-051, JS-052, JS-056, JS-062, JS-104, JS-106, JS-109, JS-113, JS-114, JS-117, JS-119, JS-122, JS-124, JS-127, JS-129, JS-202, JS-203, JS-204, JS-206, JS-207, JS-208, JS-209; except do not use silicone sealant at joints receiving field applied paint coatings.
 - 2) Contraction joints: JS-051, JS-052, JS-056, JS-062, JS-104, JS-106, JS-109, JS-113, JS-114, JS-117, JS-119, JS-122, JS-124, JS-127, JS-129, JS-202, JS-203, JS-204, JS-206, JS-207, JS-208, JS-209; except do not use silicone sealant at joints receiving field applied paint coatings.
 - 3) Expansion joints: JS-051, JS-056, JS-106, JS-206; except do not use silicone sealant at joints receiving field applied paint coatings.
 - 4) Isolation joints: JS-051, JS-052, JS-056, JS-062, JS-106, JS-117, JS-122, JS-127, JS-202, JS-206, JS-207; except do not use silicone sealant at joints receiving field applied paint coatings.
 - b. Unit masonry including clay (brick), concrete (CMU), and stone units:
 - 1) Control joints: JS-051, JS-052, JS-056, JS-062, JS-106, JS-117, JS-122, JS-127, JS-202, JS-206, JS-207.
 - 2) Expansion joints: JS-051, JS-056, JS-106, JS-206.
 - c. Exterior insulation and finish systems (EIFS), stucco:
 - 1) Control joints: JS-001, JS-002, JS-003, JS-004, JS-009, JS-011, JS-012, JS-014, JS-117, JS-122, JS-127, JS-202, JS-206, JS-207; except do not use silicone sealant at joints receiving field applied paint coatings.
 - 2) Expansion joints: JS-001, JS-002, JS-011, JS-012, JS-106, JS-206; except do not use silicone sealant at joints receiving field applied paint coatings.
 - d. Between materials listed above and perimeter of frames of doors, window, louvers, and similar building envelope penetrations:
 - 1) Perimeter joints (not expansion joints): Sealant selected for use on materials listed above, except do not use silicone sealant at joints receiving field applied paint coatings.
 - 2) Expansion joints: Expansion joint sealant selected for use on materials listed above, except do not use silicone sealant at joints receiving field applied paint coatings.

3. Interior joints in horizontal traffic surfaces.

- a. Cast-in-place concrete slabs and decks:
 - 1) Contraction control joints: JS-011, JS-012, JS-014, JS-016, JS-019, JS-021, JS-106, JS-109, JS-113, JS-114, JS-122, JS-124, JS-127, JS-129, except as follows:
 - a) For locations receiving wheeled equipment and vehicular traffic provide semirigid joint filler specified under Section 03 30 00 "Cast-In-Place Concrete."
 - 2) Expansion joints: JS-011, JS-016, JS-021, JS-106.
 - 3) Isolation joints: JS-011, JS-012, JS-016, JS-021, JS-106, JS-122, JS-127.
 - b. Ceramic tile flooring:
 - 1) Control joints: JS-011, JS-012, JS-014, JS-016, JS-019, JS-021, JS-106.
 - 2) Expansion joints: JS-011, JS-016, JS-021.
 - 3) Isolation joints: JS-011, JS-012, JS-016, JS-021.
4. Interior joints in vertical surfaces and horizontal nontraffic surfaces, subject to differential movement, including ceilings, soffits and other overhead surfaces.
- a. Exposed interior surfaces including ceilings, soffits, walls, and partitions:
 - 1) Control joints: JS-001, JS-002, JS-011, JS-012, JS-106, JS-117, JS-122, JS-202, JS-206, JS-207; except as follows:
 - a) Do not use silicone sealants and joints receiving field applied paint coatings.
 - b) For materials listed below use sealants indicated.
 - 2) Expansion joints: JS-001, JS-011, JS-106, JS-206; except as follows:
 - a) Do not use silicone sealants at joints receiving field applied paint coatings.
 - b) For materials listed below use sealants indicated.
 - b. Ceramic tile:
 - 1) Control joints: JS-001, JS-002, JS-011, JS-012, JS-206, JS-207,
 - 2) Expansion joints: JS-001, JS-011, JS-206.
 - c. Exposed surfaces of unit masonry and concrete, walls and partitions:
 - 1) Vertical control joints: JS-051, JS-052, JS-056, JS-062, JS-106, JS-117, JS-122, JS-202, JS-206, JS-207; except do not use silicone sealants at joints receiving field applied paint coatings.

- 2) Vertical expansion joints: JS-051, JS-056, JS-106, JS-206; except do not use silicone sealants at joints receiving field applied paint coatings.
5. Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement; dry locations only.
 - a. Joints in ceilings, soffits, and other overhead surfaces: JS-401, except do not use silicone containing sealant for joints receiving field applied paint coatings.
 - b. Joints between interior wall surfaces and perimeter of door and opening frames, windows, and elevator entrances. JS-401, except do not use silicone containing sealant for joints receiving field applied paint coatings.
6. Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces, including ceilings, soffits and other overhead surfaces; including in rooms with sinks, showers, toilets, urinals, and similar plumbing fixtures.
 - a. Plumbing fixtures and adjoining walls, floors, and counters:
 - 1) Joints between fixture and adjacent surface: JS-254, JS-257; except use only JS-257 where receiving field applied paint coatings.
7. Concealed mastics.
 - a. Metal thresholds: JS-351

1.03 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.

1.04 QUALITY ASSURANCE

- A. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.05 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.01 JOINT SEALANTS, GENERAL

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

2.02 SILICONE JOINT SEALANTS

- A. JS-001 - Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
- B. JS-002 - Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
- C. JS-003 - Silicone, S, NS, 35, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability. nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 35, Use NT.
- D. JS-004 - Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
- E. JS-009 - Silicone, Acid Curing, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
- F. JS-011 - Silicone, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
- G. JS-012 - Silicone, S, NS, 50, T, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Uses T and NT.
- H. JS-014 - Silicone, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Uses T and NT.

- I. JS-016 - Silicone, S, P, 100/50, T, NT: Single-component, pourable, plus 100 percent and minus 50 percent movement capability traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 100/50, Uses T and NT.
- J. JS-019 - Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.
- K. JS-021 - Silicone, M, P, 100/50, T, NT: Multicomponent, pourable, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type M, Grade P, Class 100/50, Uses T and NT.

2.03 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. JS-051 - Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
- C. JS-052 - Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
- D. JS-056 - Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
- E. JS-062 - Silicone, Nonstaining, M, NS, 50, NT: Nonstaining, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Use NT.

2.04 URETHANE JOINT SEALANTS

- A. JS-104 - Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

- B. JS-106 - Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
- C. JS-109 - Urethane, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Uses T and NT.
- D. JS-113 - Urethane, S, P, 35, T, NT: Single-component, pourable, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 35, Uses T and NT.
- E. JS-114 - Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.
- F. JS-117 - Urethane, M, NS, 50, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Use NT.
- G. JS-119 - Urethane, M, NS, 25, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Use NT.
- H. JS-122 - Urethane, M, NS, 50, T, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Uses T and NT.
- I. JS-124 - Urethane, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Uses T and NT.
- J. JS-127 - Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 50, Uses T and NT.
- K. JS-129 - Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 25, Uses T and NT.

2.05 SILYL-TERMINATED POLYETHER (STPE) JOINT SEALANTS

- A. JS-202 - STPE, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

- B. JS-203 - STPE, S, NS, 35, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 35, Use NT.
- C. JS-204 - STPE, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
- D. JS-206 - STPE, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 100, Uses T and NT.
- E. JS-207 - STPE, S, NS, 50, T, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Uses T and NT.
- F. JS-208 - STPE, S, NS, 35, T, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 35, Uses T and NT.
- G. JS-209 - STPE, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Uses T and NT.

2.06 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. JS-254 - Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
- C. JS-257 - STPE, Mildew Resistant, S, NS, 50, NT: Mildew-resistant, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

2.07 BUTYL JOINT SEALANTS

- A. JS-351 - Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

2.08 LATEX JOINT SEALANTS

- A. JS-401 - Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

2.09 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance, and type indicated below except where approved otherwise in writing by joint-sealant manufacturer for joint application indicated:

1. Location, Exterior:

a. Exposure, Wet:

1) Position, Vertical:

- a) Type C (closed cell material with a surface skin).
- b) Type B (bicellular material with a surface skin).

2) Position, Horizontal:

- a) Type C (closed cell material with a surface skin).
- b) Type B (bicellular material with a surface skin).

b. Exposure, Dry:

1) Position, Vertical: Type B (bicellular material with a surface skin).

2) Position, Horizontal: Type B (bicellular material with a surface skin).

2. Location, Interior:

a. Exposure, Wet:

1) Position, Vertical:

- a) Type C (closed cell material with a surface skin).
- b) Type B (bicellular material with a surface skin).

2) Position, Horizontal:

- a) Type C (closed cell material with a surface skin).
- b) Type B (bicellular material with a surface skin).

b. Exposure, Dry:

1) Position, Vertical:

- a) Type O (open-cell material)
- b) Type B (bicellular material with a surface skin).

2) Position, Horizontal: Type B (bicellular material with a surface skin).

- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.10 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

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

3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
 4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C 1193.
 5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.04 CLEANING

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

3.05 PROTECTION

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

END OF SECTION 07 92 00

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Door hardware.
2. Gate Hardware, panics only.

B. Related Divisions:

1. Division 07 – sealant at exterior thresholds

C. Specific Omissions: Hardware for the following is specified or indicated elsewhere.

1. Windows.
2. Cabinets, including open wall shelving and locks.
3. Signs, except where scheduled.
4. Toilet accessories, including grab bars.
5. Installation.
6. Rough hardware.
7. Conduit, junction boxes & wiring.
8. Access doors and panels, except cylinders where detailed.
9. Welded steel gates and supports.

1.02 REFERENCES:

A. Use date of standard in effect as of Bid date.

1. American National Standards Institute
 - a. ANSI 156.18 – Materials and Finishes.
2. BHMA – Builders Hardware Manufacturers Association
3. 2019 California Building Code
 - a. Chapter 11B – Accessibility To Public Buildings, Public Accommodations, Commercial Buildings and Public Housing
4. DHI – Door and Hardware Institute
5. NFPA – National Fire Protection Association
 - a. NFPA 80 2019 Edition – Standard for Fire Doors and Other Opening Protectives.
 - b. NFPA 105 – Smoke and Draft Control Door Assemblies
 - c. NFPA 252 – Fire Tests of Door Assemblies

6. UL – Underwriters Laboratories
 - a. UL10C – Positive Pressure Fire Tests of Door Assemblies.
 - b. UL 305 – Panic Hardware
7. WHI – Warnock Hersey Incorporated State of California Building Code
8. Local applicable codes
9. SDI – Steel Door Institute
10. WI – Woodwork Institute
11. AWI – Architectural Woodwork Institute
12. NAAMM – National Association of Architectural Metal Manufacturers

B. Abbreviations

1. Manufacturers: see table at 2.1.A of this section
2. Finishes: see 2.7 of this section.

1.03 SUBMITTALS & SUBSTITUTIONS

- A. SUBMITTALS: Organize vertically formatted schedule into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Minimum 10pt font size. Include following information:
1. Type, style, function, size, quantity and finish of hardware items.
 2. Use BHMA Finish codes per ANSI A156.18.
 3. Name, part number and manufacturer of each item.
 4. Fastenings and other pertinent information.
 5. Location of hardware set coordinated with floor plans and door schedule.
 6. Explanation of abbreviations, symbols, and codes contained in schedule.
 7. Mounting locations for hardware.
 8. Door and frame sizes, materials and degrees of swing.
 9. List of manufacturers used and their nearest representative with address and phone number.
 10. Catalog cuts.
 11. Point-to-point wiring diagrams.
 12. Manufacturer’s technical data and installation instructions for electronic hardware.
- B. Bid and submit manufacturer’s updated/improved item if scheduled item is discontinued.
- C. Deviations: Highlight, encircle or otherwise identify deviations from “Schedule of Finish Hardware” on submittal with notations clearly designating those portions as deviating from this section.
- D. If discrepancy between drawings and scheduled material in this section, bid the more expensive of the two choices, note the discrepancy in the submittal and request direction from Architect for resolution.

- E. Substitutions per Division 1. Include product data and indicate benefit to the Project. Furnish operating samples on request.
- F. Items listed with no substitute manufacturers have been requested by Owner to meet existing standard.
- G. Furnish as-built/as-installed schedule with closeout documents, including keying schedule, riser and point-to-point wiring diagrams, manufacturers' installation, adjustment and maintenance information, and supplier's final inspection report.

1.04 QUALITY ASSURANCE:

- A. Qualifications:
 - 1. Hardware supplier: direct factory contract supplier who employs a certified architectural hardware consultant (AHC), available at reasonable times during course of work for project hardware consultation to Owner, Architect and Contractor.
 - a. Responsible for detailing, scheduling and ordering of finish hardware. Detailing implies that the submitted schedule of hardware is correct and complete for the intended function and performance of the openings.
- B. Hardware: Free of defects, blemishes and excessive play. Obtain each kind of hardware (latch and locksets, exit devices, hinges and closers) from one manufacturer.
- C. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.
- D. Fire-Rated Openings: NFPA 80 compliant. Hardware UL10C (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved-bearing hinges, and resilient seals. Coordinate with wood door section for required intumescent seals. Furnish openings complete.
- E. Furnish hardware items required to complete the work in accordance with specified performance level and design intent, complying with manufacturers' instructions and code requirements.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Delivery: coordinate delivery to appropriate locations (shop or field).
 - 1. Permanent keys and cores: secured delivery direct to Owner's representative.
- B. Acceptance at Site: Items individually packaged in manufacturers' original containers, complete with proper fasteners and related pieces. Clearly mark packages to indicate contents, locations in hardware schedule and door numbers.

- C. Storage: Provide securely locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, dust, excessive heat and cold, etc.

1.06 PROJECT CONDITIONS AND COORDINATION:

- A. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical the same operation and quality as type specified, subject to Architect's approval.
- B. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents. Furnish related trades with the following information:
 - 1. Location of embedded and attached items to concrete.
 - 2. Location of wall-mounted hardware, including wall stops.
 - 3. Location of finish floor materials and floor-mounted hardware.
 - 4. At masonry construction, coordinate with the anchoring and hollow metal supplier prior to frame installation by placing a strip of insulation, wood, or foam, on the back of the hollow metal frame behind the rabbet section for continuous hinges, as well as at rim panic hardware strike locations, silencers, coordinators, and door closer arm locations. When the frame is grouted in place, the backing will allow drilling and tapping without dulling or breaking the installer's bits.
 - 5. Locations for conduit and raceways as needed for electrical, electronic and electro-pneumatic hardware items. Fire/life-safety system interfacing. Point-to-point wiring diagrams plus riser diagrams to related trades.
 - 6. Coordinate: flush top rails of doors at outswinging exteriors, and throughout where adhesive-mounted seals occur.
 - 7. Manufacturers' templates to door and frame fabricators.
- C. Check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.
- D. Environmental considerations: segregate unused recyclable paper and paper product packaging, uninstalled metals, and plastics, and have these sent to a recycling center.

1.07 WARRANTY:

- A. Part of respective manufacturers' regular terms of sale. Provide manufacturers' written warranties.
- B. Include factory order numbers with close-out documents warranty information:
- C. Minimum warranties:
 - 1. Locksets: Three years
 - 2. Extra Heavy Duty Cylindrical Lock: Seven Years

3.	Exit Devices:	Three years mechanical One year electrical
4.	Closers:	Thirty years mechanical Two years electrical
5.	Hinges:	One year
6.	Other Hardware	Two years

1.08 COMMISSIONING:

- A. Conduct these tests prior to request for certificate of substantial completion:
 - 1. With installer present, test door hardware operation with climate control system and stairwell pressurization system both at rest and while in full operation.
 - 2. With installer, access control contractor and electrical contractor present, test electrical, electronic and electro-pneumatic hardware systems for satisfactory operation.
 - 3. With installer and electrical contractor present, test hardware interfaced with fire/life-safety system for proper operation and release.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Listed acceptable alternate manufacturers: these will be considered; submit for review products with equivalent function and features of scheduled products.

ITEM:	MANUFACTURER:	ACCEPTABLE ALTERNATE:
Hinges	(IVE) Ives	Bommer
Mechanical Locks	(SCH) Schlage	Owner standard
Exit Devices	(VON) Von Duprin	Owner standard
Closers	(LCN) LCN	Owner standard
Silencers	(IVE) Ives	Rockwood, Trimco
Kickplates	(IVE) Ives	Rockwood, Trimco
Stops & Holders	(IVE) Ives	Rockwood, Trimco
Thresholds	(ZER)Zero	NGP, Reese
Seals & Bottoms	(ZER)Zero	NGP, Reese

2.02 HINGING METHODS:

- A. Drawings typically depict doors at 90 degrees, doors will actually swing to maximum allowable. Use wide-throw conventional or continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening. Advise architect if 8-inch width is insufficient.
- B. Doors 3'6" or wider use 5" X 4 1/2" heavy weight hinges
- C. Doors 8'0" use 4 hinges and add 1 hinge for every foot thereafter
- D. Conform to manufacturer's published hinge selection standard for door dimensions, weight and frequency, and to hinge selection as scheduled. Where manufacturer's standard exceeds the scheduled product, furnish the heavier of the two choices, notify Architect of deviation from scheduled hardware.

- E. Conventional Hinges: Steel or stainless steel pins and approved bearings. Hinge open widths minimum, but of sufficient throw to permit maximum door swing.
 - 1. Outswinging exterior doors: stainless steel hinges with non-removable (NRP) pins and security studs.
 - 2. Stainless steel material exteriors and at doors subject to corrosive atmospheric conditions.

2.03 LOCKSETS, LATCHSETS, DEADBOLTS:

- A. Mortise Locksets and Latchsets: as scheduled.
 - 1. Chassis: cold-rolled steel, handing field-changeable without disassembly.
 - 2. Universal lock case – 10 functions in one case.
 - 3. Floating mounting tabs automatically adjusts to fit a beveled door edge.
 - 4. Latchbolts: 0.75 inch throw stainless steel anti-friction type.
 - 5. Lever Trim: through-bolted, accessible design, cast lever or solid extruded bar type levers as scheduled. Filled hollow tube design unacceptable.
 - a. Spindles: security design independent breakaway. Breakage of outside lever does not allow access to inside lever's hubworks to gain wrongful entry.
 - b. Inside lever applied by screwless shank mounting – no exposed trim mount screws.
 - c. Levers rotate up or down for ease of use.
 - 6. Furnish solid cylinder collars with wave springs. Wall of collar to cover rim of mortise cylinder.
 - 7. Turnpieces: accessible offset turn-lever design not requiring pinching or twisting motions to operate.
 - 8. Deadbolts: stainless steel 1-inch throw.
 - 9. Strikes: 16 gage curved steel, bronze or brass with 1 inch deep box construction, lips of sufficient length to clear trim and protect clothing.
 - 10. Scheduled Lock Series and Design: Schlage L series, Design to be 06A
 - 11. Certifications:
 - a. ANSI A156.13, 1994, Grade 1 Operational,
 - b. ANSI/ASTM F476-84 Grade 31 UL Listed.
 - 12. Accessibility: Require not more than 5 lb to retract the latchbolt or deadbolt, or both, per CBC 2019 11B-404.2.7 and 11B-309.4.

2.04 EXIT DEVICES / PANIC HARDWARE

- A. General features:
 - 1. Independent lab-tested 1,000,000 cycles.

2. Push-through push-pad design. No exposed push-pad fasteners, no exposed cavities when operated. Return stroke fluid dampeners and rubber bottoming dampeners, plus anti-rattle devices.
3. Deadlocking latchbolts, 0.75 inch projection.
4. End caps: impact-resistant, flush-mounted. No raised edges or lips to catch carts or other equipment.
5. No exposed screws to show through glass doors.
6. Non-handed basic device design with center case interchangeable with all functions, no extra parts required to effect change of function.
7. Releasable in normal operation with 15-pound maximum operating force per UBC Standard 10-4, and with 32-pound maximum pressure under 250-pound load to the door.
8. Lever design to match locksets
9. Accessibility: Require not more than 5 lb to retract the latchbolt, per CBC 2019 11B-404.2.7 and 11B-309.4.
 - a. Mechanical method: where touchpad directly retracts the latchbolt with 5 lb or less of force.

2.05 CLOSERS

A. Surface Closers: 4040-XP

1. Full rack-and-pinion type cylinder with removable non-ferrous cover and cast iron body. Double heat-treated pinion shaft, single piece forged piston, chrome-silicon steel spring.
2. ISO 2000 certified. Units stamped with date-of-manufacture code.
3. Independent lab-tested 10,000,000 cycles.
4. Non-sized, non-handed, and adjustable. Place closer inside building, stairs, and rooms.
5. Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.
6. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2019 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.
 - a. Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leafs or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.
7. Separate adjusting valves for closing speed, latching speed and backcheck, fourth valve for delayed action where scheduled.
8. Extra-duty arms (EDA) at exterior doors scheduled with parallel arm units.
9. Exterior door closers: tested to 100 hours of ASTM B117 salt spray test, furnish data on request.
10. Exterior doors: seasonal adjustments not required for temperatures from 120 degrees F to -30 degrees F, furnish checking fluid data on request.
11. Non-flaming fluid, will not fuel door or floor covering fires.

12. Pressure Relief Valves (PRV) not permitted.

2.06 OTHER HARDWARE

- A. Kick Plates: Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.
- B. Door Stops: Provide stops to protect walls, casework or other hardware.
 - 1. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where floor type cannot be used, provide wall type. If neither can be used, provide overhead type.
 - 2. Locate overhead stops for maximum possible opening. Consult with Owner for furniture locations. Minimum: 90deg stop / 95deg deadstop. Note degree of opening in submittal.
- C. Thresholds: As scheduled and per details. Comply with CBC 2019 11B-404.2.5. Substitute products: certify that the products equal or exceed specified material's thickness. Proposed substitutions: submit for approval.
 - 1. Saddle thresholds: 0.125 inches minimum thickness.
 - 2. Exteriors: Seal perimeter to exclude water and vermin. Use sealant complying with requirements in Division 7 "Thermal and Moisture Protection". Minimum 0.25 inch diameter fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors. National Guard Products' "COMBO" or Pemko Manufacturing's "FHSL".
 - 3. Fire-rated openings, 90-minutes or less duration: use thresholds to interrupt floor covering material under the door where that material has a critical radiant flux value less than 0.22 watts per square centimeter, per NFPA 253. Use threshold unit as scheduled. If none scheduled, include a 0.25in high 5in wide saddle in the bid, and request direction from Architect.
 - 4. Fire-rated openings, 3-hour duration: Thresholds, where scheduled, to extend full jamb depth.
 - 5. Acoustic openings: Set units in full bed of Division-7-compliant, leave no air space between threshold and substrate.
 - 6. Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.
 - 7. Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Pinned TORX drive at high security areas. Flat head sleeve anchors (FHSL) may be slotted drive. Sheet metal and wood screws: full-thread. Sleeve nuts: full length to prevent door compression.

2.07 FINISH:

- A. Generally: BHMA 626 Satin Chromium Areas using BHMA 626: furnish push-plates, pulls and protection plates of BHMA 630, Satin Stainless Steel, unless otherwise scheduled.

1. Door closers: factory powder coated to match other hardware, unless otherwise noted.

2.08 KEYING REQUIREMENTS:

A. KEYING REQUIREMENTS:

- B. Key System: Keying, keyways, system security etc will be determined at a later time. For estimate use standard cores with the following

C. Keys

1. Factory registered master key system
2. Non-I.C. construction keying: furnish inserted type partial key. At substantial completion, remove inserts in Owner's presence; demonstrate consequent non-operability of construction key. Give all removed inserts and all construction keys to Owner, provide accounting for all the pieces.
3. Temporary cylinders/cores remain supplier's property.
4. Furnish 10 construction keys.
5. Furnish 2 construction insert extractor tool 35-057.
6. Furnish 2 construction control keys.

- D. Key Cylinders: furnish, 6-pin solid brass construction.

- E. Cylinders/Cylinder cores: furnish keyed at factory of lock manufacturer where permanent records are maintained. Locks and cylinders same manufacturer.

- F. Permanent keys: furnish secured shipment direct from point of origination to Owner.

1. For estimate: 3 keys per change combination, 5 master keys per group, 5 grand-master keys, 3 control keys.
2. For estimate: VKC stamping plus "DO NOT DUPLICATE".

- G. Bitting List: furnish secured shipment direct from point of origination to Owner upon completion.

PART 3 - EXECUTION

3.01 ACCEPTABLE INSTALLERS:

- A. Can read and understand manufacturers' templates, suppliers' hardware schedule and printed installation instructions. Can readily distinguish drywall screws from manufacturers' furnished fasteners. Available to meet with manufacturers' representatives and related trades to discuss installation of hardware.

3.02 PREPARATION:

- A. Ensure that walls and frames are square and plumb before hardware installation. Make corrections before commencing hardware installation. Installation denotes acceptance of wall/frame condition.
- B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.
 - 1. Notify Architect of code conflicts before ordering material.
 - 2. Locate latching hardware between 34 inches to 44 inches above the finished floor, per California Building Code, Section 1010.1.9.2 and 11B-404.2.7.
 - 3. Locate panic hardware between 36 inches to 44 inches above the finished floor.
 - 4. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.
- C. Overhead stops: before installing, determine proposed locations of furniture items, fixtures, and other items to be protected by the overhead stop's action.

3.03 INSTALLATION

- A. Install hardware per manufacturer's instructions and recommendations. Do not install surface-mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation. Remove and reinstall or replace work deemed defective by Architect.
 - 1. Gaskets: install jamb-applied gaskets before closers, overhead stops, rim strikes, etc; fasten hardware over and through these seals. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.
 - 2. When hardware is to be attached to existing metal surface and insufficient reinforcement exists, use RivNuts, NutSerts or similar anchoring device for screws.
 - 3. Use manufacturers' fasteners furnished with hardware items, or submit Request for Substitution with Architect.
 - 4. Replace fasteners damaged by power-driven tools.
- B. Locate floor stops no more that 4 inches from walls and not within paths of travel. See paragraph 2.2 regarding hinge widths, door should be well clear of point of wall reveal. Point of door contact no closer to the hinge edge than half the door width. Where situation is questionable or difficult, contact Architect for direction.
- C. Core concrete for exterior door stop anchors. Set anchors in approved non-shrink grout.
- D. Locate overhead stops for minimum 90 degrees at rest and for maximum allowable degree of swing.
- E. Drill pilot holes for fasteners in wood doors and/or frames.

- F. Lubricate and adjust existing hardware scheduled to remain. Carefully remove and give to Owner items not scheduled for reuse.

3.4. ADJUSTING

- G. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.
 - 1. Hardware damaged by improper installation or adjustment methods: repair or replace to Owner's satisfaction.
 - 2. Adjust doors to fully latch with no more than 1 pound of pressure.
 - a. Door closer valves: turn valves clockwise until at bottom – do not force. Turn valves back out one and one-half turns and begin adjustment process from that point. Do not force valves beyond three full turns counterclockwise.
 - 3. Adjust delayed-action closers on fire-rated doors to fully close from fully-opened position in no more than 10 seconds.
 - 4. Adjust door closers per 1.9 this section.
- H. Fire-rated doors:
 - 1. Wood doors: adjust to 0.125 inches clearance at heads, jambs, and meeting stiles.
 - 2. Steel doors: adjust to 0.063 inches minimum to 0.188 inches maximum clearance at heads, jambs, and meeting stiles.
 - 3. Adjust wood and steel doors to 0.75 inches maximum clearance (undercut) above threshold or finish floor material under door.
- I. Final inspection: Installer to provide letter to Owner that upon completion installer has visited the Project and has accomplished the following:
 - 1. Has re-adjusted hardware.
 - 2. Has evaluated maintenance procedures and recommend changes or additions, and instructed Owner's personnel.
 - 3. Has identified items that have deteriorated or failed.
 - 4. Has submitted written report identifying problems.

3.04 DEMONSTRATION:

- A. Demonstrate mechanical hardware and electrical, electronic and pneumatic hardware systems, including adjustment and maintenance procedures.

3.05 PROTECTION/CLEANING:

- A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion.

- B. Clean adjacent wall, frame and door surfaces soiled from installation / reinstallation process.

3.06 SCHEDULE OF FINISH HARDWARE

- A. See door schedule in drawings for hardware set assignments.

HW SET: 022

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY W/INDICATOR	L9440-L583-363-L283-722 06A	626	SCH
1	EA	CLOSER	4041-DA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	MOP PLATE	8400 4" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436/438 AS REQ'D	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 030

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	OFFICE LOCK	L9050P L583-363 06A	626	SCH
1	EA	DOME STOP	FS436/438 AS REQ'D	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 032

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	OFFICE LOCK	L9050P L583-363 06A	626	SCH
1	EA	CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436/438 AS REQ'D	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 050

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080P 06A	626	SCH
1	EA	DOME STOP	FS436/438 AS REQ'D	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 052

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080P 06A	626	SCH
1	EA	CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436/438 AS REQ'D	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 054

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080P 06A	626	SCH
1	EA	CLOSER	4040XP H	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436/438 AS REQ'D	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 462

3	EA	HINGE	3CB1 4.5 X 4.5 NRP SEC STUD	630	IVE
1	EA	ENTRANCE LOCK	L9453P-L583-363 06A	626	SCH
1	EA	CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	FLOOR STOP	FS441/442 AS REQUIRED	626	IVE
1	SET	PERIMETER SEALS	328AA HEAD AND JAMBS	AL	ZER
1	EA	AUTO DOOR BOTTOM	355A	AL	ZER
1	EA	THRESHOLD	AS DETAILED	AL	ZER

HW SET: 465

3	EA	HINGE	3CB1 4.5 X 4.5	630	IVE
1	EA	ENTRANCE LOCK	L9453P-L583-363 06A	626	SCH
1	EA	CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436/438 AS REQ'D	626	IVE
1	SET	PERIMETER SEALS	328AA HEAD AND JAMBS	AL	ZER
1	EA	AUTO DOOR BOTTOM	355A	AL	ZER
1	EA	THRESHOLD	AS DETAILED	AL	ZER

HW SET: 482

3	EA	HINGE	3CB1 4.5 X 4.5 NRP SEC STUD	630	IVE
1	EA	EXIT DEVICE	AX-98-L-996L-06	626	VON
1	EA	IC RIM CYLINDER	20-057-ICX	626	SCH
1	EA	CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	FLOOR STOP	FS441/442 AS REQUIRED	626	IVE
1	SET	PERIMETER SEALS	328AA HEAD AND JAMBS	AL	ZER
1	EA	AUTO DOOR BOTTOM	355A	AL	ZER
1	EA	THRESHOLD	AS DETAILED	AL	ZER

HW SET: 486

3	EA	HINGE	3CB1 4.5 X 4.5 NRP SEC STUD	630	IVE
1	EA	EXIT DEVICE	AX-98-L-NL-996L-06-LD	626	VON
1	EA	IC RIM CYLINDER	20-057-ICX	626	SCH
1	EA	CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	FLOOR STOP	FS441/442 AS REQUIRED	626	IVE
1	SET	PERIMETER SEALS	328AA HEAD AND JAMBS	AL	ZER
1	EA	AUTO DOOR BOTTOM	355A	AL	ZER
1	EA	THRESHOLD	AS DETAILED	AL	ZER

HW SET: 971

1	EA	EXIT DEVICE	AX-98-L-996L-06	626	VON
1	EA	IC RIM CYLINDER	20-057-ICX	626	SCH
			BALANCE OF HARDWARE BY GATE MANUFACTURER		B/O

END OF SECTION 08 71 00

SECTION 09 51 23 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Acoustical tiles for ceilings.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Tile: Samples of each type, color, pattern, and texture.

1.04 CLOSEOUT SUBMITTALS

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

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Units: Full-size tiles equal to 2 percent of quantity installed or two full boxes, whichever is greater.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical tiles, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.07 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations:
 - 1. Suspended Acoustical Tile Ceilings: Obtain each type of acoustical ceiling tile and its suspension system from single source from single manufacturer.
 - 2. Directly Attached Acoustical Tile Ceilings: Obtain each type of acoustical ceiling tile from single source from single manufacturer.

2.02 ACOUSTICAL TILES, GENERAL

- A. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.
- B. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.03 ACOUSTICAL TILES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. Armstrong World Industries, Inc.
 2. CertainTeed Corp.
 3. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Classification: Provide tiles complying with ASTM E 1264 for type, form, and pattern as follows:
 1. Type and Form: 24-inch by 24-inch, fissured, tegular lay-in ceiling tiles.
- C. Color: White .
- D. LR: Not less than 0.75.
- E. NRC: Not less than 0.55.
- F. Thickness: 5/8 inch .

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

3.03 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections of completed installations of acoustical tile ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion but no tiles have been installed. Do not proceed with installations of acoustical tile ceiling hangers for the next area until test results for previously completed installations of acoustical tile ceiling hangers show compliance with requirements.
 - 1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
 - 2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
- B. Acoustical tile ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.04 CLEANING

- A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 23

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Thermoset-rubber base.
- B. Related Requirements:
 - 1. Section 09 65 19 "Resilient Tile Flooring".

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

1.04 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.06 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.01 THERMOSET-RUBBER BASE

- A. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 1. Style and Location:
 - a. Style B, Cove: Provide in areas with resilient flooring.
- B. Thickness: 0.125 inch.
- C. Height: 4 inches.
- D. Lengths: Coils in manufacturer's standard length.
- E. Outside Corners: Job formed.
- F. Inside Corners: Job formed.
- G. Colors: As indicated by manufacturer's designations.

2.02 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.03 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 12 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 12 inches in length.
 - a. Miter or cope corners to minimize open joints.

3.04 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Luxury vinyl tile - LVT-1.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: Full-size units of each color and pattern of floor tile required.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.06 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockups for floor tile including resilient base and accessories.
 - a. Size: Minimum 100 sq. ft. for each type, color, and pattern in locations directed by Architect.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 60 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
 1. 48 hours before installation.
 2. During installation.
 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.01 LUXURY VINYL FLOOR TILE - LVT-1

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. Amtico International Inc.
 2. Armstrong World Industries, Inc.
 3. Burke Mercer Flooring Products, Division of Burke Industries Inc.
 4. Johnsonite; A Tarkett Company.
 5. Roppe Corporation, USA.
- B. Tile Standard: ASTM F 1700.

- 1. Class: Class III, printed film vinyl tile.
- 2. Type: B, embossed surface.
- C. Thickness: 0.980 inch.
- D. Size: As indicated on Drawings.
- E. Seaming Method for Installation:
 - 1. Seams butted.
- F. Colors and Patterns: As indicated by manufacturer's designations on Drawings.

2.02 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum percent relative humidity level as recommended by manufacturer.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.03 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 1. Lay tiles in pattern indicated.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 1. Lay tiles with grain running in one direction.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhered Tile: Adhere to flooring substrates to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections. Use a full spread of adhesive applied to substrate unless recommended otherwise by flooring manufacturer.

3.04 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

SECTION 09 67 23.37 - HEAVY DUTY RESINOUS FLOORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes:
 - 1. Urethane core resinous flooring system.
 - 2. Epoxy core resinous flooring system.
 - 3. Surface preparation including:
 - a. Abrading concrete substrates.
 - b. Treating concrete contraction, construction, and isolation joints; and cracks.
 - c. Chasing concrete substrates (key-cut termination).
- B. Contractor may use either urethane core or epoxy core system at their discretion. If epoxy core system is used a moisture vapor emissions control coating is required to be applied to surface of concrete slab.
- C. Applications include the following:
 - 1. Vehicle wash bay floors.

1.03 REFERENCE STANDARDS

- A. ACI - American Concrete Institute.
 - 1. ACI 503R Use Of Epoxy Compounds With Concrete.
- B. ASTM - ASTM International (American Society for Testing and Materials International).
 - 1. ASTM C 267 Standard Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes.
 - 2. ASTM C 307 Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing.
 - 3. ASTM C 413 Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.

4. ASTM C 531 Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 5. ASTM C 579 Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 6. ASTM C 580 Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 7. ASTM D 543 Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
 8. ASTM D 635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
 9. ASTM D 638 Standard Test Method for Tensile Properties of Plastics.
 10. ASTM D 695 Standard Test Method for Compressive Properties of Rigid Plastics.
 11. ASTM D 790 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 12. ASTM D 882 Standard Test Method for Tensile Properties of Thin Plastic Sheet.
 13. ASTM D 1308 Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
 14. ASTM D 2240 Standard Test Method for Rubber Property-Durometer Hardness.
 15. ASTM D 2370 Standard Test Method for Tensile Properties of Organic Coatings.
 16. ASTM D 4060 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
 17. ASTM D 4258 Standard Practice for Surface Cleaning Concrete for Coating.
 18. ASTM D 4259 Standard Practice for Abrading Concrete.
 19. ASTM D 4263 Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
 20. ASTM D 4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
 21. ASTM F 1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 22. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- C. ICI - International Concrete Repair Institute.
1. ICRI 310.2R Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.
- D. Military Specification.
1. MIL-D-3134J (Navy), 5 Oct. 1988 (with Amendment 1, 12 Sept. 1989): Deck Covering Materials
- E. NFPA - National Fire Protection Association.
1. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

F. SSPC - The Society for Protective Coatings.

1. SSPC-CTS 1 Concrete Coating Texture Standard, Classification of Concrete Coating Finish Textures.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review flooring requirements including materials, surface preparation, substrate condition, minimum curing period, installation procedures, coordination with other work, and protection and repairs.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

B. ASHRAE - Sustainable Design Submittals:

1. Laboratory Test Reports: For flooring products, indicating compliance with requirements for low-emitting materials.

C. Samples for Initial Selection: For each type of exposed finish required.

D. Samples for Verification: For each resinous flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.

1.06 INFORMATIONAL SUBMITTALS

A. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

B. Material Certificates: For each resinous flooring component, from manufacturer, substantiating compliance with specified performance requirements.

1. Topcoat Resistance to Chemical Reagents: Include certification that chemical reagents listed under Part 3 Article "Schedule Of Chemical Reagents" will not void manufacturer's material warranty. Include material test reports (if not a part of product data submittal) substantiating the material certification.

C. Sample Warranties: For special warranties.

1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For resinous flooring to include in maintenance manuals.
 - 1. Include procedures for cleaning chemical reagents listed under Part 3 Article "Schedule Of Chemical Reagents" from resinous flooring. Include recommended cleaning methods, equipment, materials, solutions, and exposure limits (how long reagent may remain on floor prior to causing permanent damage).

1.08 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
 - 1. Installer shall assign one field supervisor to the project who shall be on site during all phases of the Work and who shall be their primary contact.
 - 2. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Apply full-thickness mockups on 96-inch- square floor area selected by Architect.
 - a. Include 96-inch length of integral cove base with inside and outside corner.
 - 2. Simulate finished lighting conditions for Architect's review of mockups.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for 24 hours after application unless manufacturer recommends a longer period.

1.11 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace resinous flooring, including joint sealants, that fail in materials and workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish resinous flooring, including joint sealants, to repair or replace resinous flooring and those joint sealants that fail in materials and workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Resinous flooring and joint sealant failures include, but are not limited to, the following:
 - 1. Blistering and delamination.
 - 2. Swelling and softening in excess of hardness performance specified.
 - 3. Cracking.
 - 4. Chalking of topcoat.
 - 5. Loss of adhesion between resinous flooring system components and to substrate to which resinous flooring systems are applied.
 - 6. Adhesive and cohesive failure of sealants.
- D. Special warranties specified in this article exclude deterioration or failure of resinous flooring and joint sealants from the following:
 - 1. Movement of the structure caused by stresses on the resinous flooring and sealant exceeding manufacturer's written specifications for elongation and compression.
 - 2. Mechanical damage caused by individuals, tools, or other outside agents.
 - 3. Changes in appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. ASHRAE - Flooring products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Flammability: Self-extinguishing according to ASTM D 635.

2.02 MANUFACTURERS

- A. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

2.03 URETHANE CORE RESINOUS FLOORING SYSTEM

- A. Urethane Core Resinous Flooring System: Abrasion-, impact-, thermal-shock-, and chemical-resistant, aggregate-filled, and resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base. System core includes only urethane resins; system shall be water vapor permeable.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Sherwin Williams Co./General Polymers (SW/GP); FasTop 12S Urethane Slurry System using component products specified below.
 - b. Tennant Co. (Tennant); Eco-Crete Cementitious-Polyurethane Flooring System using component products specified below.
 - c. Or equal product by another manufacturer.
- B. System Characteristics:
 - 1. Wearing Surface Color: As indicated on Drawings .
 - 2. Wearing surface shall be slip resistance with texture specified below.
 - 3. Overall System Thickness: 1/4 inch.
- C. Cove Base:
 - 1. Primer:
 - a. Product and Thickness of Coats:

- 1) SW/GP; FasTop Urethane Primer GP4040; 6 mils.
 - 2) Tennant; Eco-Crete TC; 15 mils.
- b. Resin: Urethane.
 - c. Formulation Description: High solids.
 - d. Type: Clear.
 - e. Application Method: As recommended by manufacturer.
 - f. Number of Coats: One.
 - g. Filler: Manufacturer's standard.
2. Body Coat:
 - a. Product:
 - 1) SW/GP; FasTop Cove Base Resin 4060/5055.
 - 2) Tennant; Eco-Crete CB.
 - b. Resin: Urethane.
 - c. Formulation Description: High solids.
 - d. Type: Pigmented.
 - e. Application Method: Troweled.
 - f. Number of Coats: One.
 - g. Thickness of Coats (Dry/Wet): 3/16 inch.
 - h. Filler: Manufacturer's standard.
 3. Topcoat: Matching flooring.
- D. Crack Control Reinforcing Membrane: As recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated and that inhibits substrate cracks from reflecting through resinous flooring.
 - E. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
 - F. Joint Sealant: Product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
 - G. Flooring:
 1. Body Coat/Primer:
 - a. Product:
 - 1) SW/GP; FasTop 12s 4080/5080 Urethane Slurry System.
 - 2) Tennant; Eco-Crete SF.
 - b. Resin: Urethane.
 - c. Formulation Description: High solids.
 - d. Type: Pigmented.
 - e. Application Method: Self-leveling slurry with broadcast aggregates.

- f. Number of Coats: One.
 - g. Thickness of Coat (Dry/Wet): 3/16 inch.
 - h. Aggregates: Natural silica:
 - 1) FasTop 12s: 20/40 mesh
 - 2) Eco-Crete SF: 30 to 40 mesh.
2. Sealing coat.
- a. Product:
 - 1) SW/GP: Either of following:
 - a) GP 3746 High Performance Epoxy.
 - b) GP 4850 Polyaspartic Floor Coating SS.
 - 2) Tennant; Eco-Crete TC.
 - b. Resin: Urethane.
 - c. Formulation Description: High solids.
 - d. Type: Pigmented.
 - e. Number of Coats: One.
 - f. Thickness of Coat (Dry/Wet): 15 mils.
3. Topcoat: UV Resistant.
- a. Product:
 - 1) SW/GP: Either of following:
 - a) HardTop - GP 4687 Ultra High Solids Aliphatic Urethane with 5240 Aluminum Oxide; 3 mils minimum.
 - b) HardTop - GP4850 Polyaspartic with 5240 Aluminum Oxide; 10 mils minimum to 15 mils.
 - 2) Tennant; Either of following:
 - a) Eco-Crete HTS 100 (urethane); 3 mils minimum.
 - b) Eco-TCP Thick Coat Polyaspartic; 10 mils minimum (with added 220 or finer aluminum oxide added as required to produce abrasion resistance specified below).
 - b. Resin: Urethane or Polyaspartic at contractor's discretion.
 - c. Formulation Description: High solids.
 - d. Type: Pigmented.
 - e. Number of Coats: One.
 - f. Aggregates for Broadcasting:
 - 1) For Vehicular Traffic Bearing Surface: Aluminum Oxide.
 - 2) For Pedestrian Traffic Bearing Surface: Silica sand or quartz.

- g. Wearing Surface Texture: Following designations according to SSPC-CTS 1.
 - 1) For Flooring Subject to Dry Surface Exposure: CFT-A. With broadcast aggregate texture.
 - 2) For Flooring Subject to Liquid Spill or Spray Exposure: CFT-B.
 - 3) For Flooring Subject to Vehicular Wash Operations: CFT-C.
- H. Physical Properties: Provide resinous flooring with the following physical property requirements when tested according to test methods indicated:
 - 1. Body Coat/Primer:
 - a. Compressive Strength: 8,000 psi minimum according to ASTM C 579 or ASTM D 695.
 - b. Tensile Strength: Either of following:
 - 1) 900 psi minimum according to ASTM C 307.
 - 2) 6000 psi minimum according to ASTM D 638 or D 2370.
 - c. Flexural Strength: 2,500 psi minimum according to ASTM C 580 or ASTM D 790.
 - d. Hardness: 75 Shore D minimum at 0 second and 65 Shore D minimum at 15 seconds according to ASTM D 2240.
 - 2. Topcoat:
 - a. Tensile Strength: 6000 psi minimum according to ASTM D 638, ASTM D 882, or ASTM D 2370.
 - b. Elongation: 6 percent minimum according to ASTM D 638, ASTM D 882, or ASTM D 2370.
 - c. Abrasion Resistance: 40 mg. maximum weight loss according to ASTM D 4060 (using CS-17 Taber abrasion wheel, 1,000 gram load, 1,000 revolutions).
 - d. Chemical Resistance: Topcoat shall be substantially resistant to the chemical reagents listed under Part 3 Article "Schedule Of Chemical Reagents."
 - 3. System Bond Strength/Adhesion to Concrete: 300 psi minimum and 100 percent concrete failure according to ASTM D 4541 or ACI 503R.

2.04 EPOXY CORE RESINOUS FLOORING SYSTEM

- A. Epoxy Core Resinous Flooring System: Abrasion-, impact-, and chemical-resistant, aggregate-filled, and resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base. System core includes epoxy resins.
 - 1. Product: Subject to compliance with requirements, provide one of the following:

- a. DiamondStone (DS); Diamond-HD System Textured using component products specified below.
- b. Sherwin Williams Co./General Polymers (SW/GP) using component products specified below.
- c. Tennant Co. (Tennant); 1/4" Overlay Satin System using component products specified below.
- d. Or comparable product by another manufacturer.

B. System Characteristics:

- 1. Wearing Surface Color: Light gray .
- 2. Wearing surface shall be slip resistance with texture specified below.
- 3. Overall System Thickness: 1/4 inch.

C. Cove Base:

1. Primer:

a. Product and Thickness of Coat (Dry/Wet):

- 1) DS; .Diamond-Eprime; 10 mils.
- 2) SW/GP; GP 3561V Epoxy Cove Paste (neat, without aggregate); in thickness recommended by manufacturer.
- 3) Tennant; Eco-MPE Multi-Purpose Epoxy; 7 mils minimum to 9 mils.

- b. Resin: Epoxy.
- c. Formulation Description: High solids.
- d. Type: Clear to amber.
- e. Application Method: As recommended by manufacturer.
- f. Number of Coats: One.
- g. Filler: Manufacturer's standard.

2. Intermediate Coats:

a. Products:

- 1) DS; Matching flooring.
- 2) SW/GP; GP 3561V Epoxy Cove Paste.
- 3) Tennant; Matching flooring.

b. Thickness of Coats (Dry/Wet): 3/16 inch.

3. Topcoat: Matching flooring.

D. Crack Control Reinforcing Membrane: As recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated and that inhibits substrate cracks from reflecting through resinous flooring.

E. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

- F. Joint Sealant: Product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
- G. Flooring:
1. Coating for Moisture Vapor Emissions Control:
 - a. Product and Thickness of Coat (Dry/Wet):
 - 1) DS; Diamond-VRS; Two coats. First coat at 8 mils and cured; second coat at 10 mils to which Body/Mortar Coat is applied while primer is wet.
 - 2) SW/GP; GP 3830 Resuprime; 16 mils minimum to 20 mils.
 - 3) Tennant; Eco-MVR/Eco-MVS; 7 mils minimum or greater as required for moisture vapor emission rates encountered.
 - b. Formulation: Compatible with Primer or Body/Mortar Coat applied over it.
 2. Primer: May be omitted if manufacturer allows moisture vapor emissions control coating to serve as primer for body/mortar coat.
 - a. Product and Thickness of Coat (Dry/Wet):
 - 1) DS; Diamond-Eprime; 10 mils minimum.
 - 2) SW/GP; GP 3579 Standard Epoxy Primer/Binder; 8 mils minimum to 12 mils.
 - 3) Tennant; Eco-MPE Multi-Purpose Epoxy; 7 mils minimum to 9 mils.; with angular aggregate broadcast to rejection.
 - b. Resin: Epoxy.
 - c. Formulation Description: High solids.
 - d. Type: Clear to amber.
 - e. Application Method: As recommended by manufacturer.
 - f. Number of Coats: One.
 3. Body/Mortar Coat:
 - a. Product:
 - 1) DS; Diamond-HD.
 - 2) SW/GP; GP 3561/5115 Epoxy Resin Glaze mortar.
 - 3) Tennant; Eco-PT 250.
 - b. Resin: Epoxy.
 - c. Formulation Description: High solids.
 - d. Type: Pigmented.
 - e. Number of Coats: One.
 - f. Thickness of Coat (Dry/Wet): 1/4 inch.
 - g. Aggregates: Manufacturer's standard.

4. Grout Coat:
 - a. Product and Thickness of Coat (Dry/Wet):
 - 1) DS; HD-Topcoat; 10 mils.
 - 2) SW/GP; GP 3746 High Performance Epoxy; 16 mils minimum to 20 mils.
 - 3) Tennant; Eco-PT Topcoat; 5 mils minimum to 8 mils.
 - b. Resin: Epoxy.
 - c. Formulation Description: High solids.
 - d. Type: Pigmented.
 - e. Application Method: As recommended by manufacturer.
 - f. Number of Coats: One.
5. Smoothing Coat: May be omitted where wearing surface texture greater than CFT-B is specified.
 - a. Product:
 - 1) DS: Diamond-Epoxy AP.
 - 2) SW/GP; GP 3746 High Performance Epoxy.
 - 3) Tennant; Eco-MPE.
 - b. Resin: Epoxy.
 - c. Formulation Description: High solids.
 - d. Type: Pigmented.
 - e. Application Method: As recommended by manufacturer to produce flat, smooth surface.
 - f. Number of Coats: One.
 - g. Thickness of Coat (Dry/Wet): As required to produce flat, smooth surface.
6. Topcoat: UV Resistant.
 - a. Product and Thickness of Coat (Dry/Wet):
 - 1) DS; Eco-Top (Urethane); 3 mils minimum.
 - 2) SW/GP: Either of following:
 - a) HardTop - GP 4687 Ultra High Solids Aliphatic Urethane with 5240 Aluminum Oxide; 3 mils minimum.
 - b) HardTop - GP4850 Polyaspartic Floor Coating SS with 5240 Aluminum Oxide; 10 mils. minimum to 15 mils.
 - 3) Tennant: Either of following:
 - a) Eco-Crete HTS 100 (urethane); 3 mils minimum.
 - b) Eco-TCP Thick Coat Polyaspartic; 10 mils minimum (with added 220 or finer aluminum oxide added as required to produce abrasion resistance specified below).

- b. Resin: Urethane or polyaspartic at contractor's discretion.
 - c. Formulation Description: High solids.
 - d. Type: Pigmented.
 - e. Number of Coats: One.
 - f. Aggregates for Broadcasting:
 - 1) For Vehicular Traffic Bearing Surface: Aluminum Oxide.
 - 2) For Pedestrian Traffic Bearing Surface: Silica sand or quartz.
 - g. Wearing Surface Texture: Following designations according to SSPC-CTS 1.
 - 1) For Flooring Subject to Liquid Spill or Spray Exposure: CFT-B.
 - 2) For Flooring Subject to Vehicular Wash Operations: CFT-C.
- H. Physical Properties: Provide resinous flooring with the following physical property requirements when tested according to test methods indicated:
- 1. Body/Mortar Coat:
 - a. Compressive Strength: 8,000 psi minimum according to ASTM C 579 or ASTM D 695.
 - b. Tensile Strength: Either of following:
 - 1) 900 psi minimum according to ASTM C 307.
 - 2) 6000 psi minimum according to ASTM D 638 or D 2370.
 - c. Flexural Strength: 2,500 psi minimum according to ASTM C 580 or ASTM D 790.
 - d. Hardness: 75 Shore D minimum at 0 second and 65 Shore D minimum at 15 seconds according to ASTM D 2240.
 - 2. Topcoat:
 - a. Tensile Strength: 6000 psi minimum according to ASTM D 638, ASTM D 882, or ASTM D 2370.
 - b. Elongation: 6 percent minimum according to ASTM D 638, ASTM D 882, or ASTM D 2370.
 - c. Abrasion Resistance: 40 mg. maximum weight loss according to ASTM D 4060 (using CS-17 Taber abrasion wheel, 1,000 gram load, 1,000 revolutions).
 - d. Chemical Resistance: Topcoat shall be substantially resistant to the chemical reagents listed under Part 3 Article "Schedule Of Chemical Reagents."
 - 3. System Bond Strength/Adhesion to Concrete: 300 psi minimum and 100 percent concrete failure according to ASTM D 4541 or ACI 503R.

2.05 ACCESSORY MATERIALS

- A. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.
- B. Protect adjacent surfaces and adjoining walls from contact with resinous flooring materials.
- C. Concrete Substrates: Provide sound concrete surfaces free of contaminants incompatible with resinous flooring.
 - 1. Mechanically abrade surface to a uniform profile acceptable to manufacturer, according to ASTM D 4259. Do not acid etch.
 - a. Minimum Concrete Surface Profile (CSP): CSP 5 per ICRI 310.2R.
 - b. Remove grease, oil, paints, and other penetrating contaminants from concrete.
 - c. Remove concrete fins, ridges, and other projections.
 - d. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.
 - e. Remove remaining loose material to provide a sound surface, and clean surfaces according to ASTM D 4258.
 - 1) Clean surfaces with a magnetic sweeper to remove residual metallic particles.
 - 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
 - 3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. of slab area in 24 hours.
 - b. Plastic Sheet Test: ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.

- c. Relative Humidity Test: Use in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- 4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- D. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- E. Concrete Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent them from reflecting through resinous flooring according to manufacturer's written instructions.
- F. Concrete Expansion, Isolation, and Construction Joints: Prepare joints as follows:
 - 1. Open existing joints by removing residual sealants and backer rod.
 - 2. In each joint, to prevent resinous flooring materials from filling joint, place (temporarily) a continuous length of round polyethylene backer rod flush with floor's surface and under about 30 percent compression.
- G. Concrete Chasing (Key-Cut or Key-In Termination): Provide a recess for resinous materials to key into by sawing or cutting a chase not less than 1/4-inch wide by 1/4-inch deep; chamfer edge located beneath resinous flooring. Cut chases at locations including, but not limited to, the following:
 - 1. Locations where resinous flooring terminates in field of concrete
 - 2. Locations where separate, abutting applications of resinous flooring are applied at different times or in a sequence of phases.
- H. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

3.02 APPLICATION, GENERAL

- A. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
 - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
 - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
- B. Concrete Expansion, Isolation, and Construction Joint Treatment: Comply with resinous flooring manufacturer's written instructions and the following.
 - 1. After resinous flooring materials have been placed over joints (previously filled with backer rod), saw cut joints to original width, to a minimum 1/2 inch depth, completely removing cured resinous material and previously placed backer rod.

- a. Protect adjacent resinous surfaces for cutting operations.
2. Install closed cell polyethylene backer rod into joint; recess face of backer to a depth about 1/2 the width of the joint and under about 30 percent compression.
3. Apply joint sealant over backer rod. Face of sealant shall be slightly concave below top of floor surface, no more than 1/8 inch.

3.03 APPLICATION - URETHANE CORE RESINOUS FLOORING SYSTEM

- A. Floor Body Coat/Primer: Apply self-leveling slurry body coat in thickness indicated under Part 2 Article "Resinous Flooring - Urethane Core System." Broadcast aggregates over wet slurry, to rejection, in accordance with manufacturer's written instructions. After resin is cured, remove excess aggregates to provide surface texture indicated.
- B. Crack Control Reinforcing Membrane: Apply reinforcing membrane to substrate cracks according to manufacturer's written instructions and details.
- C. Integral Cove Base: Apply cove base primer and body coat in thicknesses indicated under Part 2 Article "Resinous Flooring - Urethane Core System."
 1. Apply to wall and other vertical surfaces before applying flooring.
 2. Apply according to manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base.
 3. Round internal and external corners.
 4. When body coat is cured, remove trowel marks and roughness using method recommended by manufacturer.
 5. Base Height: 6 inches.
- D. System Seal Coat: Apply sealcoat over body coat in number of coats and thickness indicated under Part 2 Article "Resinous Flooring - Urethane Core System."
- E. System Topcoat: Apply topcoat over seal coat in number of coats and thickness indicated under Part 2 Article "Resinous Flooring - Urethane Core System" and to produce wearing surface texture indicated.

3.04 APPLICATION - EPOXY CORE RESINOUS FLOORING SYSTEM

- A. Coating for Moisture Vapor Emissions Control: Apply over prepared substrate in number of coats and thickness(es) indicated under Part 2 Article "Resinous Flooring - Epoxy Core System" to control moisture vapor emissions and pH determined by testing.
- B. Primer: Apply over prepared substrate at manufacturer's recommended spreading rate. (Primer may be omitted if manufacturer allows moisture vapor emissions control coating to serve as primer for body/mortar coat.)

- C. Crack Control Reinforcing Membrane: Apply reinforcing membrane to substrate cracks according to manufacturer's written instructions and details.
- D. Integral Cove Base: Apply cove base primer and body coat in thicknesses indicated under Part 2 Article "Resinous Flooring - Epoxy Core System."
 - 1. Apply to wall and other vertical surfaces before applying flooring.
 - 2. Apply according to manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base.
 - 3. Round internal and external corners.
 - 4. When body coat is cured, remove trowel marks and roughness using method recommended by manufacturer.
 - 5. Base Height: 6 inches.
- E. Floor Body/Mortar Coat: Apply in thickness indicated under Part 2 Article "Resinous Flooring - Epoxy Core System" by screeding and troweling or other method recommended by manufacturer. After coating has cured, sand or grind to remove high spots and other surface imperfections. Vacuum loose material.
- F. Grout Coat: Apply over body/mortar coat in thickness indicated under Part 2 Article "Resinous Flooring - Epoxy Core System " and to produce wearing surface texture indicated. If sanded, vacuum loose material.
- G. Smoothing Coat: Apply over grout coat in thickness indicated under Part 2 Article "Resinous Flooring - Epoxy Core System" and to produce wearing surface texture indicated. Smoothing coat may be omitted where wearing surface texture greater than CFT-B is specified.
- H. System Topcoat: Apply over smoothing coat in thickness indicated under Part 2 Article "Resinous Flooring - Epoxy Core System" and to produce wearing surface texture indicated.

3.05 PROTECTION

- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

3.06 SCHEDULE OF CHEMICAL REAGENTS

- A. Resinous flooring system topcoat shall be substantially resistant to the following chemical reagents and cleaning procedures:
 - 1. Acids:
 - a. Battery Acid.
 - 2. Oils, Greases, Fuels, Solvents:

- a. Engine oils.
 - b. Gear oils.
 - c. Hydraulic oils.
 - d. Compressor oils.
 - e. Greases.
 - f. Brake fluids.
 - g. Automatic Transmission Fluids (ATF).
 - h. Penetrants like WD-40 and Rust Buster.
3. Cleaners, Degreasers, Detergents, and Soaps:
- a. Alkaline degreasers like Fastball and Powerball.
 - b. Biodegradable cleaners/degreasers like MrGreen.
 - c. Brake cleaners.
 - d. Electrical cleaners.
 - e. Parts cleaner fluids like Ozzy Juice.
 - f. Heavy duty cleaners like Revolution.
 - g. Glass cleaners like Crystal Clear.
 - h. Germicidal cleaners & deodorants like QD-64.
 - i. Heavy duty hand scrubbing/soap solutions like Homerun and ISI-Poly Dish Soap.
4. Miscellaneous Reagents:
- a. Engine coolants.
 - b. Windshield wiper fluid.
 - c. Armor All.
 - d. Micro Leak Detector.
 - e. Insect repellents.
 - f. Paints.
5. Cleaning Methods:
- a. By hot water/detergent pressure spray equipment.
 - b. By machine polishing/buffing equipment using liquid cleaning and polishing solutions.

END OF SECTION 09 67 23.37

SECTION 09 90 00 - PAINTING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes surface preparation and the application of paint systems on

1. Exterior/Interior substrates:
2. The following Exterior/Interior substrates:
 - a. Concrete masonry units (CMU)
 - b. Steel
 - c. Galvanized metal
 - d. Wood

1.02 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 35 units at 85 degrees, according to ASTM D 523
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.
- H. EG: Ethylene Glycol. Ethylene glycol is listed as a hazardous air pollutant (HAP) by the
- I. U.S. EPA
- J. Blocking: Two painted surfaces sticking together such as a painted door sticking to a painted jamb.
- K. RAVOC: Reactivity adjusted VOC 'Reactivity' means the ability of a VOC to promote ozone formation.
- L. PDCA: Painting & Decorating Contractors of America www.pdca.org
- M. SSPC: Scopes of SSPC Surface Preparation Standards and Specifications. www.sspc.org
- N. Owner – usage of the term “Owner” shall be construed to mean the actual owner of the Property or a duly authorized representative of the owner.
- O. Property – usage of the term “Property” shall be construed to mean the property at which location the work shall be performed.

- P. Painting Contractor – usage of the term “Contractor” shall be construed to mean the 3rd party contractor performing the painting portion of the project.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, no smaller than 7 inches by 10 inches or larger than 8.5 inches by 11 inches.
 - 2. Label each Sample for project, owner’s agent, general contractor, painting contractor, paint color name and number, paint brand name, 'P' number if applicable, and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas.
 - 2. VOC content.

1.04 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials from the same product run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Ten percent, but not less than 1 gal. of each material and color applied.

1.05 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Owner’s agent will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other Items: Owner’s agent will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by owner’s agent at a cost to be agreed upon by Contractor and Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the paint systems indicated unless owner’s agent specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C) or more than 120 deg F (49 deg C).

- 1. Maintain containers in clean condition, free of foreign materials and residue.
- 2. Remove rags and waste from storage areas daily.

1.07 FIELD CONDITIONS

- A. Surfaces must be clean and moisture free. Prime and paint as soon as possible. Do not apply paints in snow, rain, fog, or mist. No painting shall be done immediately after rain or foggy weather or when the temperature is below 50 °F. Substrate temperature must be 5 °F or more above dew point temperature while painting and during the coating's cure time. Avoid painting surfaces while they are exposed to a full, hot sun.
- B. Painting contractor should follow proper painting practices and exercise judgment based on his or her experience and project specific conditions as to when to proceed.
- C. Wind Velocity: Excessive wind velocity can seriously impair spray application, resulting in significant material loss, low film build, excessive dry spray or overspray, plus the possibility of depositing airborne spray mist on unprotected surfaces downwind from the work. Some of these adverse effects can be compensated for by material and equipment adjustments if winds are not too high. Generally speaking, wind velocity 15 m.p.h. or higher can cause sufficient spray application problems, in which case suspending work until conditions improve should be considered.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products manufactured or distributed by the Dunn-Edwards Corporation, or approved equal product(s).

2.02 PAINT, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- C. Colorants: The use of colorants containing hazardous chemicals, such as ethylene glycol, is prohibited.
- D. Colors: As Selected by owner's agent from manufacturer's full range.
 - 1. Where color is selected prior to bid submittal, Contractor shall bid, two (2), or more finish coats, as appropriate to the color selected, and shall expressly state number of finish and prime coats and type (full or spot) of prime coat.

2. When the final color has not been selected prior to bid submittal, Contractor may need to bid additional coats when submitting their bid. The Owner should be aware that if a color is chosen following the bid process and the color is significantly different from original color, a change order for an additional finish coat might be required.

2.03 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure.
 1. Owner may engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove non-complying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will comply with requirements to use compatible products and systems as described in Paragraph 2.02.A. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. Interior Substrates:
 - a. Concrete: 11 percent or less.
 - b. Masonry (Clay and CMU): 11 percent or less.
 - c. Wood: 8 percent or less.
 - d. Plaster: 5 percent or less.
 - e. Gypsum Board: 5 percent or less.
 2. Exterior Substrates:
 - a. Concrete: 11 percent or less.
 - b. Masonry (Clay and CMU): 11 percent or less.
 - c. Wood: 15 percent or less.

- d. Plaster: 5 percent or less.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured, including pH testing to determine that alkalinity is within limits established by the manufacturer.
- D. Interior and/or exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- E. Concrete floors require a calcium chloride test to measure hydrostatic pressure. Consult floor coating manufacturer with test results prior to beginning surface preparation.
- F. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- G. Proceed with coating application only after unsatisfactory conditions have been corrected.

- 1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.
- B. Scraping or sanding surfaces of older buildings (especially pre-1978) may release dust containing lead or asbestos. EXPOSURE TO LEAD OR ASBESTOS CAN BE VERY HAZARDOUS TO YOUR HEALTH. Always wear appropriate personal protective equipment during surface preparation, and finish cleanup of any residues by water- washing all surfaces. For more information, see Dunn-Edwards brochure on "Surface Preparation Safety" or call EPA's National Lead Information Hotline at 1-800-424-LEAD, or visit www.epa.gov/lead or/asbestos, or contact your state or local Health Department.
- C. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- D. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and re-prime substrate with compatible primers or apply bond coat as required to produce paint systems indicated.
- E. Where mildew is present, remove mildew by scrubbing with a commercial mildew remover, or, with a solution of one (1) part household bleach mixed in three (3) parts water by volume. The solution should be left on the surface for a minimum of twenty (20) minutes, rinsed thoroughly with clean water to remove any residue, and then allowed to dry completely prior to application of patching/caulking/prime/finish coat systems.

- F. Moisture: All areas that may cause paint failure due to moisture shall be addressed and eliminated. This would include, but is not limited to:
1. Gutters and downspouts not working properly.
 2. Previous coats of paint not adhering properly.
 3. Wood checking (cracks and splits in wood).
 4. Deteriorated caulking.
 5. Gaps between substrates.
 6. Rotten wood.
 7. Areas affected by water splashing.
 8. Painting in inclement weather.
 9. Painting a substrate where residual moisture exceeds limits stated in 3.1.B.
 10. Un-caulked nail holes.
- G. Pressure washing and surface preparation methods:
1. Pressure wash or water blast to remove oil, grease, dirt, loose mill scale, and loose paint at pressures of 2500-3500 p.s.i. at a flow of 3.0-3.5 gallons per minute. This is the recommended standard for optimal efficiency.
- H. Prior to application of prime/finish interior and/or exterior coat systems, provide a clean, sound surface free of dust, dirt contaminants, mildew and efflorescence by use of a power wash and hand scraping or use of mechanical grinders where necessary. Additionally, areas are to be scrubbed with a bristle brush to insure complete removal of any residual salts. Remove all labels, stickers, price tags, etc. from surfaces before priming. Wood areas stamped with ink codes must be spot primed with blocking primers. Power wash areas to be coated to ensure that new salt deposits do not occur. Failure to do so may cause adhesion issues or result in delamination and invalidate any manufacturer warranty given or implied. After cleaning if there is still chalk evident, this condition must be brought to the owner's attention in writing before any further work is done.
- I. Cementitious Substrates: (concrete, stucco, masonry) Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
1. Wire brush all loose and peeling paint and dust all surfaces before spot priming or applying finish coats. Industry standards apply to applications of cracks, voids, and repairs. Any areas of repair shall be patched and dried before coatings are applied. Cracks should be repaired as follows:
 - a. Cracks less than 1/4" wide should be filled using Dunn-Edwards Brush Grade Elastomeric Patch.

- b. Cracks wider than 1/4" should be cut and scraped to a "V" shape and filled with Dunn-Edwards Trowel Grade Elastomeric Patch.
 - c. Large cracks and holes may require repeated applications of patching materials to bring flush with adjacent substrate. Feather-in all repairs and caulking to blend with adjacent substrate.
 - 2. Large holes in stucco / plaster/ concrete will be patched with Rapid Set Premium Stucco Patch or Rapid Set Wunderfixx Concrete Patching Compound in appropriate texture to blend with existing texture. Allow stucco patch to cure to acceptable pH level (10) prior to application of prime/finish coat systems. Caulk large cracks in stucco / plaster/ cement with GE-Life Time 920.
 - 3. Spot prime over all patched areas, cracks, and holes then use an appropriate topping material to match existing surface level and texture.
- J. All Metal Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing.
 - a. SSPC-SP 1, "Solvent Cleaning."
 - b. SSPC-SP 2, "Hand Tool Cleaning."
 - c. SSPC-SP 3, "Power Tool Cleaning."
 - 1. All ferrous metals should be thoroughly cleaned and all loose rust or mill scale be removed by wire brush, scraper and/or power tool, such as an electric drill with a wire brush attachment. Any rust spots or bare metal should receive the appropriate prime coat. Rust inhibited primer to be applied on all properly prepared surfaces where rust is evident. Any hard, glossy surfaces should be dulled. Previously painted ferrous metal in sound condition should be washed down with a strong detergent-type cleaner such as Krud-Kutter or Simple Green.
 - 2. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
 - 3. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
 - a. All galvanized gutters and flashing should be thoroughly cleaned to remove loose and peeling paint.
 - b. Any bare galvanized metal should be wiped down with a non-petroleum solvent cleaner.
 - c. Prime bare metal with the specified galvanized metal primer.
 - d. Any rust on galvanized metal must be removed. Clean to bare metal and apply a rust inhibitive primer.
 - 4. Aluminum Substrates: Remove loose surface oxidation.

K. Wood Substrates:

1. All deteriorated or delaminated substrates (i.e. wood, hardboard siding, T1-11) shall be replaced. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for interior and/or exterior use in paint system indicated.
2. Sand and dust surfaces that will be exposed to view.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
5. Spot prime all patched and filled areas as well as any new wood with the appropriate primer or sealer as stated in the Finish Schedule.

3.03 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations.
 1. Use applicators and techniques suited for paint and substrate indicated.
 2. The number of coats scheduled is the minimum number of coats required. Additional coat(s) shall be applied at no additional cost to the Owner, to completely hide base material, provide uniform color, and to produce satisfactory finish results.
 3. Apply coatings without thinning except as specifically required by label directions or required by these specifications. In such cases, thinning shall be the minimum reduction permitted.
 4. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 5. Paint both sides and edges of interior and/or exterior doors and entire exposed surface of interior and/or exterior door frames.
 6. Paint entire exposed surface of window frames and sashes.
 7. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 8. Priming may not be required on items delivered with prime or shop coats, unless otherwise specified. Touch up prime coats applied by others as required ensuring an even primed surface before applying finish coat.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Block Fillers: Provide block fill as scheduled to conform to the following PDCA Standard P12-05.

1. Level 3 - Premium fill: One or multiple coats of high performance block filler manufactured to be applied at a high dry film build. Block filler shall be back-rolled to eliminate voids and reduce the majority of the masonry profile depth.
- F. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed to view:
 - a. Equipment, including panel boards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.

3.04 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by owner's agent, and leave in an undamaged condition.
- D. At completion of activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 EXTERIOR / INTERIOR PAINTING SCHEDULE

- A. Prepare, paint, and finish all surfaces specified and agreed upon.
- B. Provide paint finishes of even uniform color, free from cloudy or muddled appearance. Properly correct all non-complying work to the satisfaction of owner and owner's representative and the representative of the paint manufacturer.
- C. Paint application finish schedule:

1. EXTERIOR MASONRY, STUCCO, BUILDING WALLS

- a. First Coat: EFF-STOP Select Masonry Primer/Sealer (ESSL00)
- b. Second Coat: SPARTASHIELD, Exterior 100% Acrylic Eggshell Paint (SSHL30)
- c. Third Coat: SPARTASHIELD, Exterior 100% Acrylic Eggshell Paint (SSHL30)
- d. Special Notes and Instructions:

Please refer to the Dunn-Edwards' Product Data Sheet for all important information, such as surface preparation and application. It is the Painting Contractor's responsibility to read and to be in conformance to this specification and to the paint manufacturer's instructions on the labels and product information sheets.

Any / all damaged masonry surfaces must be repaired / patched. Texture must match surrounding surface as close as possible.

2. EXTERIOR MASONRY, CMU, BUILDING WALLS

- a. First Coat: Smooth BLOCFIL Select Interior/Exterior Concrete Block Filler (SBSL00)
- b. Second Coat: SPARTASHIELD, Exterior 100% Acrylic Eggshell Paint (SSHL30)
- c. Third Coat: SPARTASHIELD, Exterior 100% Acrylic Eggshell Paint (SSHL30)
- d. Special Notes and Instructions:

Please refer to the Dunn-Edwards' Product Data Sheet for all important information, such as surface preparation and application. It is the Painting Contractor's responsibility to read and to be in conformance to this specification and to the paint manufacturer's instructions on the labels and product information sheets.

3. EXTERIOR METAL FACTORY FINISH, CORRUGATED SIDING, OVERHANG, ROLL-UP DOORS

- a. Spot Prime: BLOC-RUST Premium, Rust-Preventative Metal Primer (BRPR00 Series)
- b. First Coat: SUPER-LOC Premium, Interior/Exterior Masonry/Bonding Primer (SLPR00-2-WH)
- c. Second Coat: SPARTASHIELD, Exterior 100% Acrylic Eggshell Paint (SSHL30) Third Coat: SPARTASHIELD, Exterior 100% Acrylic Eggshell Paint (SSHL30)
- d. Special Notes and Instructions:

Please refer to the Dunn-Edwards' Product Data Sheet for all important information, such as surface preparation and application. It is the Painting Contractor's responsibility to read and to be in conformance to this specification and to the paint manufacturer's instructions on the labels and product information sheets.

4. EXTERIOR GALVANIZED METAL, GUTTERS, DOWNSPOUTS, FLASHING, VENTS

- a. First Coat: ULTRA-GRIP Select, Interior/Exterior Multi-Surface Primer (UGSL00)
- b. Second Coat: SPARTASHIELD, Exterior 100% Acrylic Eggshell Paint (SSHL30)
- c. Third Coat: SPARTASHIELD, Exterior 100% Acrylic Eggshell Paint (SSHL30)
- d. Special Notes and Instructions:

Please refer to the Dunn-Edwards' Product Data Sheet for all important information, such as surface preparation and application. It is the Painting Contractor's responsibility to read and to be in conformance to this specification and to the paint manufacturer's instructions on the labels and product information sheets.

A full prime of ULGM00-0-WH, Ultrashield, Galvanized Metal Primer (UGLM00-0-WH) is required for New / Raw Galvanized Metal Surfaces.

5. EXTERIOR METAL, DOORS AND FRAMES, STEEL FRAMING, BEAMS

- a. First Coat: BLOC-RUST Premium, Rust-Preventative Metal Primer (BRPR00 Series)
- b. Second Coat: SPARTASHIELD, Exterior 100% Acrylic Semi-Gloss Paint (SSHL50)
- c. Third Coat: SPARTASHIELD, Exterior 100% Acrylic Semi-Gloss Paint (SSHL50)
- d. Special Notes and Instructions:

Please refer to the Dunn-Edwards' Product Data Sheet for all important information, such as surface preparation and application. It is the Painting Contractor's responsibility to read and to be in conformance to this specification and to the paint manufacturer's instructions on the labels and product information sheets.

6. EXTERIOR WOOD, TRIM, FASCIA

- a. First Coat: ULTRA-GRIP Select, Interior/Exterior Multi-Surface Primer (UGSL00)
- b. Second Coat: SPARTASHIELD, Exterior 100% Acrylic Eggshell Paint (SSHL30)

- c. Third Coat: SPARTASHIELD, Exterior 100% Acrylic Eggshell Paint (SSHL30)

- d. Special Notes and Instructions:

Please refer to the Dunn-Edwards' Product Data Sheet for all important information, such as surface preparation and application. It is the Painting Contractor's responsibility to read and to be in conformance to this specification and to the paint manufacturer's instructions on the labels and product information sheets.

A full prime of EZPR00, EZ-Prime Premium Exterior Wood Primer (EZPR00) is required for New / Raw Unpainted Wood Surfaces. All New / Raw Unpainted Wood Surfaces must be primed on all six sides.

7. INTERIOR, GYPSUM BOARD, WALLS

- a. Spot Prime: ULTRA-GRIP Select, Interior/Exterior Multi-Surface Primer (UGSL00)

- b. First Coat: SPARTAWALL, Interior Eggshell Paint (SWLL30)

- c. Second Coat: SPARTAWALL, Interior Eggshell Paint (SWLL30)

- d. Special Notes and Instructions:

Please refer to the Dunn-Edwards' Product Data Sheet for all important information, such as surface preparation and application. It is the Painting Contractor's responsibility to read and to be in conformance to this specification and to the paint manufacturer's instructions on the labels and product information sheets.

8. INTERIOR METAL FACTORY FINISH, CORRUGATED SIDING, CEILING

- a. Spot Prime: BLOC-RUST Premium, Rust-Preventative Metal Primer (BRPR00 Series)

- b. First Coat: SUPER-LOC Premium, Interior/Exterior Masonry/Bonding Primer (SLPR00-2-WH)

- c. Second Coat: SPARTAWALL, Interior Eggshell Paint (SWLL30)

- d. Third Coat: SPARTAWALL, Interior Eggshell Paint (SWLL30)

- e. Special Notes and Instructions:

Please refer to the Dunn-Edwards' Product Data Sheet for all important information, such as surface preparation and application. It is the Painting Contractor's responsibility to read and to be in conformance to this specification and to the paint manufacturer's instructions on the labels and product information sheets.

9. INTERIOR GALVANIZED METAL, HVAC

- a. Spot Prime: ULTRA-GRIP Premium, Acrylic Multi Purpose Primer (UGPR00 Series)

- b. First Coat: SPARTAWALL, Interior Eggshell Paint (SWLL30)

- c. Second Coat: SPARTAWALL, Interior Eggshell Paint (SWLL30)

d. Special Notes and Instructions:

Please refer to the Dunn-Edwards' Product Data Sheet for all important information, such as surface preparation and application. It is the Painting Contractor's responsibility to read and to be in conformance to this specification and to the paint manufacturer's instructions on the labels and product information sheets.

A full prime of ULGM00-0-WH, Ultrashield, Galvanized Metal Primer (UGLM00-0-WH) is required for New / Raw Galvanized Metal Surfaces.

10. INTERIOR METAL, STEEL FRAMING, BEAMS, PIPES

a. First Coat: BLOC-RUST Premium, Rust-Preventative Metal Primer (BRPR00 Series)

b. Second Coat: SPARTAWALL, Interior Eggshell Paint (SWLL30)

c. Third Coat: SPARTAWALL, Interior Eggshell Paint (SWLL30)

d. Special Notes and Instructions:

Please refer to the Dunn-Edwards' Product Data Sheet for all important information, such as surface preparation and application. It is the Painting Contractor's responsibility to read and to be in conformance to this specification and to the paint manufacturer's instructions on the labels and product information sheets.

11. INTERIOR WOOD, CABINETS

a. First Coat: DECOPRIME INT CABINET, DOOR & TRIM PRIME (DCPR00)

b. Second Coat: DECOGLO Interior Eggshell Cabinet, Door & Trim Paint

c. Third Coat: DECOGLO Interior Eggshell Cabinet, Door & Trim Paint

d. Special Notes and Instructions:

Please refer to the Dunn-Edwards' Product Data Sheet for all important information, such as surface preparation and application. It is the Painting Contractor's responsibility to read and to be in conformance to this specification and to the paint manufacturer's instructions on the labels and product information sheets.

12. For lead safety refer to 3.2 B. and Dunn-Edwards PDS sheets under Special Instructions.

END OF SECTION 09 90 00

SECTION 09 96 56.13 - EPOXY COATINGS FOR WASH BAY WALLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes surface preparation and the application of high-performance coating systems - systems with one or more epoxy resin components - on concrete and masonry substrates of walls, steel framing and decking ceilings, and horizontal non-traffic bearing surfaces , including incidental metal substrates a part of surfaces.
- B. Related Requirements:
 - 1. Section 09 67 23.37 "Resinous Flooring For Wash Bays" for field applied epoxy coatings applied to wash bay concrete floors.
 - 2. Section 09 96 00 "High-Performance (Epoxy) Coatings" for field applied epoxy coatings.

1.03 REFERENCES

- A. ASTM - ASTM International (American Society for Testing and Materials International).
 - 1. ASTM D2240 Standard Test Method for Rubber Property-Durometer Hardness.
 - 2. ASTM D4060 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
 - 3. ASTM D4060 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
 - 4. ASTM D7234 Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
- B. SSPC - The Society for Protective Coatings.
 - 1. SSPC-PA 1, Shop, Field, and Maintenance Painting of Steel.
 - 2. SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning
 - 3. SSPC-SP 7/NACE No. 4, Brush-Off Blast Cleaning.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Indicate VOC content.
- B. ASHRAE - Sustainable Design Submittals:
 - 1. Product Data: For paints and coatings, indicating VOC content.
- C. Samples for Initial Selection: For each type of topcoat product indicated.
- D. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.

1.05 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
 - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

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

1.07 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F, unless indicated otherwise on manufacturer's product data.
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.01 EPOXY COATINGS, GENERAL

- A. Material Compatibility:
 - 1. Materials for use within coating system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a coating system, products shall be recommended in writing by topcoat manufacturers for use in coating system and on substrate indicated.
 - 3. Products shall be of same manufacturer for each coat in a coating system.
- B. ASHRAE - Emissions Requirements: Field-applied paints and coatings that are inside the weatherproofing system shall comply with either of the following:
 - 1. ASHRAE - VOC content shall not exceed limits of authorities having jurisdiction and the following:
 - a. Nonflat Coatings: 100 g/L.
 - b. Primers, Sealers, and Undercoats: 100 g/L.

2.02 EPOXY COATINGS FOR WASH BAYS

- A. Epoxy Wall System: Smooth, epoxy resin coating system formulated to produce a chemical resistant, seamless surface on walls, ceilings, and horizontal non-traffic bearing surfaces of material type indicated on Drawings.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Tennant Co. (Tennant); Tennant Glaze Wall System using products indicated below or equal by one of the following:
 - 1. Behr Process Corporation.
 - 2. Benjamin Moore & Co.
 - 3. Comex Industrial Coatings; Comex Group.
 - 4. Corotech Coatings; Benjamin Moore & Co.
 - 5. Devoe Paint Company; AkzoNobel.
 - 6. Diamond Vogel Paints.
 - 7. PPG Architectural Finishes, Inc.
 - 8. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
 - 9. Sherwin-Williams Company (The).
 - 10. Tnemec Inc.
- C. System Characteristics:
 - 1. Nominal System Thickness: 18 mils.
- D. Patching Material:
 - 1. Basis-of-Design Product: Tennant; Eco-PT Topcoat.
 - 2. Resin: 100 percent solids epoxy.
 - 3. Thickness of Coat (Dry/Wet): As required for conditions encountered; and as a filler for concrete masonry units (CMU).
- E. Primer:
 - 1. Basis-of-Design Product: Tennant; Eco-MPE.
 - 2. Resin: 99 percent solids epoxy.
 - 3. Thickness of Coat (Dry/Wet): 4 mils.
- F. Intermediate Coat:
 - 1. Basis-of-Design Product: Tennant; Eco-PT Topcoat.
 - 2. Resin: 100 percent solids epoxy.
 - 3. Thickness of Coat (Dry/Wet): 6 mils.
 - 4. Color: Matching topcoat.
- G. Topcoat:
 - 1. Basis-of-Design Product: Tennant; Eco-URE/OP.
 - 2. Resin: Epoxy.

3. Thickness of Coat (Dry/Wet): 8 mils.
 4. Surface Texture: Smooth orange peel.
 5. Color: White .
- H. System Physical Properties: Provide resinous epoxy system with the following minimum or better physical property requirements when tested according to test methods indicated:
1. Bond Strength: Either of following:
 - a. 100 percent substrate failure when tested according to ASTM D 4541 on CMU, gypsum board or cement board substrates.
 - b. 100 percent of failure of 400 psi concrete substrate when tested according to ASTM D 7234.
 2. Hardness: Not less than 80 when tested according to ASTM D 2240, Shore D.
 3. Temperature Resistance: To 200 deg F.
 4. Abrasion Resistance (Topcoat): 90.0 mg. maximum weight loss according to ASTM D 4060 (using CS-17 Taber abrasion wheel, 1,000 gram load, 1,000 revolutions).

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. Concrete: 12 percent.
 2. Concrete Masonry Units (CMUs): 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions applicable to substrates and coating systems indicated.

- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing coating operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 1. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 to 12 inches.
 - 2. Abrasive blast clean surfaces to comply with SSPC-SP 7/NACE No. 4.
 - 3. Clean surfaces using a proprietary prepackaged acid etching solution in accordance with manufacturer's written recommendations.
- E. Concrete Masonry Unit (CMU) Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or alkalinity of mortar joints exceeds that permitted in manufacturer's written instructions.
 - 1. Clean surfaces with pressurized water. Use pressure range of 100 to 600 psi at 6 to 12 inches.
- F. Shop-Primed Steel and Iron Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 (Shop, Field, and Maintenance Painting of Steel) for touching up shop-primed surfaces.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.
- H. Aluminum Substrates: Remove loose surface oxidation.

3.03 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment same as similar exposed surfaces.

3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.04 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

END OF SECTION 09 96 56.13

SECTION 10 14 23 - PANEL SIGNAGE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Panel signs.
 - 2. Room-identification signs.

1.03 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.04 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For panel signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.
- C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Panel Signs: Not less than 12 inches square, including corner.
 - 2. Room-Identification Signs: Full-size Sample.

3. Variable Component Materials: Full-size Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
 4. Exposed Accessories: Full-size Sample of each accessory type.
 5. Full-size Samples, if approved, will be returned to Contractor for use in Project.
- D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Sample Warranty: For special warranty.

1.07 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SIGNS

- A. Panel Sign : Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 1. Solid-Sheet Sign: Aluminum sheet with finish specified in "Surface Finish and Applied Graphics" Subparagraph below and as follows:
 - a. Thickness: Manufacturer's standard for size of sign.
 - b. Surface-Applied Graphics: Applied vinyl film baked enamel or powder coat paint.
 - c. Inset, Cutout Characters: Sign face routed to receive push-through acrylic graphics flush with the sign panel.
 2. Mounting: As indicated Manufacturer's standard method for substrates indicated Surface mounted to wall with adhesive two-face tape.
 3. Surface Finish and Applied Graphics:

- a. Baked-Enamel or Powder-Coat Finish and Graphics: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
 - b. Painted Finish and Graphics: Manufacturer's standard, factory-applied exterior-grade sign paint, in color as selected by Architect from manufacturer's full range.
- 4. Text and Typeface: Accessible raised characters and Braille Times Roman typeface as indicated by manufacturer's designation typeface matching Architect's sample typeface as selected by Architect from manufacturer's full range variable content as scheduled.
- 5. Flatness Tolerance: Sign panel shall remain flat or uniformly curved under installed conditions as indicated and within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.
- B. Room-Identification Sign : Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated over subsurface graphics to acrylic backing sheet to produce composite sheet.
 - a. Composite-Sheet Thickness: As indicated.
 - b. Color(s): As selected by Architect from manufacturer's full range.
 - 2. Sign-Panel Perimeter: Finish edges smooth.
 - a. Edge Condition: As indicated.
 - b. Corner Condition in Elevation: As indicated.
 - 3. Mounting: Surface mounted to wall with two-face tape.
 - 4. Text and Typeface: Accessible raised characters and Braille. Finish raised characters to contrast with background color, and finish Braille to match background color.

2.02 PANEL-SIGN MATERIALS

- A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated and suitable for exterior applications.
- C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.03 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 - 2. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 - b. Fastener Heads: For nonstructural connections, use oval countersunk screws and bolts with tamper-resistant one-way-head slots unless otherwise indicated.
 - 3. Sign Mounting Fasteners:
 - a. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
 - b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.
- B. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.04 FABRICATION

- A. Shop- and Subsurface-Applied Vinyl: Align vinyl film in final position and apply to surface. Firmly press film from the middle outward to obtain good bond without blisters or fishmouths.

2.05 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.06 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify that anchor inserts are correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls as indicated and according to accessibility standards.
- C. Mounting Methods:
 - 1. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

- a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
- 2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
- 3. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
- 4. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

3.03 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 23

SECTION 10 41 16.13 - FIRE DEPARTMENT KEYED ACCESS CONTROL SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Fire Department key storage box ("knox box").

1.02 COORDINATION

- A. Key Storage Box: Coordinate locations with Owner and local Fire Department.

1.03 ACTION SUBMITTALS

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

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire department keyed access control specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.01 FIRE DEPARTMENT KEY STORAGE BOX

- A. General: Heavy-duty, UL Rated, high-security, factory finished metal box designed to store building keys for Fire Department access.
 - 1. Lock: Santa Barbara County fire Department registered UL listed Medeco lock cylinder.
 - 2. Door Type: Side hinged.
 - 3. Mounting: Surface or recessed mounted as directed by Fire Marshall and as suitable for mounting substrate encountered.
 - 4. Color. As selected by Fire Marshall from manufacturer's standard factory finished colors.
 - a. For box color other than red (e.g. black, silver) identify with the word "FIRE."
- 1) Location: Applied to box door.
 - 2) Application Process: Silk-screened, decals, or pressure-sensitive vinyl letters.

- 3) Lettering Color: Reflective red.
- 4) Lettering Height: Minimum 3/4 inch.
- 5) Lettering Style: Sans serif, Arial or similar, all caps.
- 6) Orientation: Horizontal.

5. Product: Knox Company; (no substitutions allowed).

- B. Fasteners for Surface Mounting: Grade 8 zinc plated steel carriage bolt not less than 5/16 inch diameter and length as required to allow 2 full threads showing after nuts are securely threaded and tightened. Include zinc plated washers and nuts.
- C. Recessed Mounting Kit: Steel box assembly with integral box mounting bolts and concrete or masonry anchors, designed to recess storage box. Provide only kits supplied by manufacturer of storage box.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, critical dimensions, and other conditions affecting performance.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to installation and performance of products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FIRE DEPARTMENT KEY STORAGE BOX

- A. Mount at main entry door of each building; verify location with Owner and local Fire Department.
- B. Mounting Height and Proximity: Bottom of key storage box shall be located not less than 36 inches and not more than 60 inches above adjacent floor or walking surface. Mount within 10 horizontal feet of entry door.
- C. Surface Mounting: Fasten key box to surface of wall with not less than 5 carriage bolts through solid blocking located in wall. Locate head of carriage bolt on interior side of building with head bearing on solid metal material. Locate threaded end of bolt and nut on interior side of key box.
- D. Recessed Mounting: Incorporate recessed mounting kit into masonry or concrete wall during wall construction. Install key box in recessed mount after walls are substantially completed and cleaned.

- E. Apply elastomeric sealant to top and side joints between key box and mounting substrate in accordance with requirements of Section 07 92 00 "Joint Sealants." Leave 3/8 inch long open gap in bottom joint for drainage.

3.03 ADJUSTING AND CLEANING

- A. Confirm that locks and box doors engage accurately and securely without forcing or binding.
- B. After completing installation of exposed, factory-finished keyed access control specialties, inspect exposed finishes and repair damaged finishes.

END OF SECTION 10 41 16.13

SECTION 11 11 26 - VEHICLE WASHING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Washer, bus, touchless/brush, hybrid with reclaim system and reverse osmosis system.
- B. Related Requirements:
 - 1. Section 01 23 00 "Alternates" for wash equipment bid alternate.
 - 2. Section 01 60 01 "Buy America Requirements" for special product requirements.

1.3 COORDINATION

- A. Coordinate size and location of recesses and inserts in concrete and masonry required for installation of equipment.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.
- C. Coordinate sizes and locations of blocking and backing required for installation of equipment attached to wall and ceiling assemblies.
- D. Coordinate locations and installation of vehicle wash equipment that may interfere with ceiling systems including lighting, electrical switches or outlets, and floor drains.
- E. Coordinate locations and requirements of utility service connections.
- F. Coordinate connection of wash equipment controls with other building elements and systems controls indicated to be interconnected.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product. Clearly mark each submittal to show which products and options are applicable; do not include manufacturer's complete catalog when pertinent information is contained on a selected page(s). Include the following:
1. Manufacturer's model number.
 2. Accessories and components that will be included for Project.
 3. Clearance requirements for access and maintenance.
 4. Utility service connections for electrical power and controls, plumbing, compressed air, and other utility services as applicable. Include rough-in dimensions.
- B. Shop Drawings: For custom fabricated vehicle wash equipment, components, furnished specialties and accessories. Include plans, elevations, sections, rough-in dimensions, fabrication details, utility service requirements, and attachments to other work.
- C. Seismic Restraint Product Data: Equipment requiring seismic restraint are itemized under Part 2 Article "Performance Requirements."
1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component required.
 2. Include one of the following types of submittals, for each type of vehicle washing equipment, substantiating that seismic restraint is suitable for conditions indicated.
 - a. Preapproved Ratings: Documentation based on preapproved ratings are preferred. Ratings shall be based on horizontal and vertical load testing and analysis.
 - 1) Provide ratings from one of the following:
 - a) ICC-ES.
 - b) OPA number from OSHPD.
 - c) An agency acceptable to authorities having jurisdiction.
 - 2) For seismic anchorage with preapproved rating, restraint devices shall bear anchorage preapproval showing maximum seismic-restraint ratings by rating agency submitted.
 - 3) If preapproved ratings are unavailable, submittals based on independent testing are preferred.
 - b. Independent Testing: Ratings based on testing by a qualified independent testing agency.
 - 1) Documentation based on independent testing are preferred to ratings based on calculations.
 - c. Delegated Design: If preapproved rating documentation or independent testing documentation are not available, provide calculations. Calculations

(including combining shear and tensile loads) to support seismic restraint designs must be signed and sealed by a qualified professional engineer.

- D. Samples for Initial Selection: For units with factory-applied color finishes.
- E. Samples for Verification: For each factory-applied color finish required, in manufacturer's standard sizes.
- F. Product Schedule: For vehicle wash equipment. Use same equipment number indicated in Specifications and on Drawings.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.
- C. Sample Warranties: For manufacturers' special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each vehicle wash equipment unit to include in operation and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include a product schedule for each vehicle wash equipment unit; include the following:
 - 1. Equipment number used in Specifications and on Drawings.
 - 2. Manufacturer's name and model number.
 - 3. Contact Information:
 - a. A list of factory-authorized service representative(s). Include street address, telephone number(s), and email address for each.
 - b. List of supplier(s) for repair parts. Include street address, telephone number(s), and email address for each.
 - 4. Description of system and components.
 - 5. Schematic Diagrams: For electrical power and controls, plumbing, compressed air, and other utility services as applicable.
 - 6. Operating Instructions: In writing by manufacturer.
 - 7. Preventative Maintenance: A written schedule of recommended procedures and frequency required to validate warranties. Failure to provide preventative maintenance information will indicate that it is not a condition for validation of warranties.
 - 8. List of manufacturer recommended maintenance materials required for 1 year of normal equipment operations.
 - 9. List of equipment manufacturer recommended brand name cleaning solutions and chemicals required for equipment operations.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Cleaning Solutions and Other Chemicals: Of each type required for not less than 5,000 vehicle cleaning cycles.

1.9 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm with not less than 5 years experience in manufacturing vehicle wash equipment units similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
 - 1. Manufacturer's Service Center: Located within 100 miles of Project site; capable of providing training, parts, and emergency maintenance repairs.
 - 2. Technical or factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by vehicle washing equipment manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
 - a. Service representative must be able to assist Owner with wash equipment malfunctions within 24 hours of notification during warranty period.
- B. Installer Qualifications: A firm or individual experienced in installing or assembling vehicle wash equipment units similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. The requirements for each type of vehicle wash equipment specify the minimum level of quality, features, performance, and construction; and originate from the basis of design product indicated.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging.
 - 1. Packaging shall be suitable for protection during shipment and storage in humid and dusty conditions.
 - 2. Outside of packaging shall be indelibly labeled with storage equipment description and number used in this specification, and with description of contents. Packaging within packaging shall be similarly labeled.
 - 3. Each equipment item shall be delivered complete in one shipment.

- B. Prior to acceptance, verify that delivery is not damaged from shipping and weather exposure. Compare packaged contents with packing list to verify complete receipt of equipment and accessories specified.
- C. Store materials, components, and equipment off the ground, under cover, and in a dry location.

1.11 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install vehicle wash equipment until spaces are enclosed and weathertight, wet work in spaces is complete and dry.

1.12 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace vehicle wash equipment units that fail in materials or workmanship within specified warranty period.
- B. Failures include, but are not limited to:
 - 1. Operation or control system failure, including excessive malfunctions.
 - 2. Performances below specified ratings.
 - 3. Excessive wear, rough operation, premature parts damage, loosening or loss, all resulting from normal operations.
 - 4. Deterioration of metals, metal finishes, and other materials beyond normal wear.
 - 5. Unsafe conditions.
 - 6. Need for excessive maintenance.
 - 7. Abnormal noise or vibration.
 - 8. Rough and substandard operation.
 - 9. Loose, damaged, and missing parts.
- C. Water reclamation system shall produce no objectionable odors or unsafe gases. If such conditions occur, manufacturer shall take corrective action(s) necessary to reduce or eliminate the cause of the odors and gases to acceptable and safe levels; and such action shall not include the use of chemical solutions.
- D. Defects shall not include damage due to neglect, misuse, or situations resulting from non-performance of a manufacturer's recommended preventive maintenance schedule.
- E. Warranty Period: 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain vehicle wash equipment from single source from single manufacturer.

2.2 SUBSTITUTION LIMITATIONS

- A. Comply with administrative and procedural requirements of Section 01 25 00 "Substitution Procedures."
 - 1. If substitutions are allowed, acceptance will be substantially based contractor's completeness in preparing comparative data (differences and similarities) between specified product or material and proposed substitution. Include attributes of specified product or material (i.e. description, reference standard, performance requirement) and corresponding attributes of substitution.

2.3 MAINTENANCE MATERIALS

- A. Repair parts for storage equipment shall be readily available from part suppliers located in the United States.
 - 1. Repair parts shall be available for no less than 7 years from date of Substantial Completion.
 - 2. Emergency parts orders shall be available for delivery within 24 hours.
 - 3. Routine parts orders shall be available for delivery within 72 hours.

2.4 REGULATORY REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 PERFORMANCE REQUIREMENTS

- A. Seismic Restraint:
 - 1. Vehicle washing equipment shall be installed with seismic-restraint devices.
 - 2. Seismic Performance: Vehicle washing equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. Component Importance Factor: 1.0.
 - b. Other Seismic Performance and Design Criteria. See Structural Drawings.
- B. Design each vehicle wash system to accommodate and effectively clean the types and quantity of vehicles indicated on the Drawings. The engineering and efficacy of each system provided shall take into account the location and climatic conditions under which the vehicles and wash systems operate.
- C. Cleaning Detergents:
 - 1. Quantity Required: Not to exceed 0.4 gallons per 45 foot long bus or equivalent.
 - 2. Ingredients: Detergents shall contains no acids containing fluorides (e.g. Hydrogen Fluoride/Hydrofluoric Acid (HF) or Ammonium-Bifluoride (ABF)).
 - 3. Effectiveness: Capable of removing most visible, heavy accumulations of dirt,

and most road film from surfaces of vehicles without damage to vehicle when passing through vehicle wash at the rate of 50 ft/min. Effectiveness of dirt and film removal shall be determined after washing and drying cycles are complete.

- D. Water reclamation system shall not generate unpleasant odors or unsafe gases.

2.6 EQUIPMENT LABELING

- A. Label each major item of equipment with a non-corrosive label with the following information permanently applied:
 - 1. Manufacturer's name and address.
 - 2. Equipment model number and serial number.
 - 3. Pertinent utility and operating data.
- B. Label Material and Thickness: Either of following:
 - 1. Brass, 0.032-inch minimum thickness.
 - 2. Stainless steel, 0.025-inch minimum thickness.
 - 3. Aluminum, 0.032-inch minimum thickness.
 - 4. Anodized aluminum, 0.032-inch minimum thickness.
 - 5. Multilayer, multicolor, plastic for mechanical engraving, 1/8-inch minimum thickness.
- C. Label text shall contrast with label background and be easily readable from 24 inches distance.
- D. Factory attached label securely on equipment in a prominent location.

2.7 VEHICLE WASH EQUIPMENT, GENERAL

- A. Provide vehicle wash equipment systems and components indicated. Where components are not otherwise indicated, provide manufacturer's standard components as required for a complete system.
- B. Provide piping, wiring, and switching from equipment to utility rough-ins as required for a complete and fully operational system(s).
- C. Fasteners and Anchors: Furnish required fasteners and anchorage devices for installing storage equipment, and furnish other components of work where installation of devices is specified in another Section.
 - 1. Concrete Floor Anchors: Stainless steel, post-installed expansion anchors. Provide number per unit recommended by manufacturer unless additional anchors are required for conditions indicated.
 - 2. Wall Anchors: Stainless steel; suitable for securing storage equipment to adjacent wall. Provide number per unit recommended by manufacturer unless additional anchors are required for conditions indicated.
- D. Cleaning Chemicals: Provide enough quantity of soap and other solutions required to

completely fill reservoirs of vehicle cleaning equipment at time of substantial completion, exclusive of extra materials required under Part 1 Article "Maintenance Material Submittals."

2.8 BUS WASHER, BRUSH, WITH RECLAIM SYSTEM AND REVERSE OSMOSIS SYSTEM

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Interclean Equipment, LLC (Ypsilanti, MI; 734-961-3300).
 - 2. N.S. Wash Systems (Inglewood, CA; 800-782-1582).
 - 3. Ross & White Company (Cary, IL; 847-516-3900).
 - 4. Westmatic Corporation (Buffalo, NY; 866-747-4567).
- B. The following requirements specify the minimum level of quality, features, performance, and construction.
- C. General Description:
 - 1. Wash System:
 - a. The equipment shall satisfactorily wash up to 25 40-foot transit buses per hour, minimum.
 - b. The bus enters the wash and shall receive full soap on roof, front, sides and rear. The undercarriage wash shall be activated for the entire length of the bus. The brushes shall be activated to wash the front, sides, and rear of the buses. After the bus passes the high pressure / brush station, it shall receive the pre-rinse, final rinse and blowers.
 - c. Each component of the bus wash system listed above shall be activated by a series of photo eyes or infrared sensors.
 - d. The vehicle wash shall be able to remove most of the visible heavy dirt accumulation and the road film from the Owner's vehicles when they are driven thru the washer at 50 feet/minute. The cleaning performance shall match and/or exceed those standards that are prevailing in the bus wash industry. No acids containing fluorides (HF or ABF) shall be allowed. The evaluation of the system capability to remove road film shall be determined only after the vehicles have dried after the washing has been completed.
 - e. The vehicle wash system shall be capable of washing all vehicles up to 12 feet in height including the following:
 - 1) Standard Transit buses (40 to 45 feet)
 - 2) Articulated Transit buses (60 feet)
 - 2. The wash system shall include a water reclamation system.
- D. Capacities/Dimensions (nominal):
 - 1. Bay length: See drawings.

2. Bay width: See drawings.
3. Minimum clearance to building structure above: See drawings.

E. Features/Performance/Construction:

1. Detergent arch and components:
 - a. The detergent arch shall provide efficient and economical vehicle coverage to the roof, front, sides, and rear of the bus.
 - b. Amount of applied detergent shall be adjustable for seasonal or Owner's requirements.
 - c. Timing of operation and position of the arch shall be determined by manufacturer to provide optimum detergent penetration before high-pressure station or brush wash cycle.
 - d. The detergent pumps shall be sized with variable volume output. The selected soap pump set up shall allow the Owner to spray separately side and rear of the vehicle at varying ratios separately. The amount of detergent delivery by the pump shall be readable on the pump calibrated settings.
 - e. The system shall have a water booster pump to ensure even water pressure under all circumstances.
 - f. The design of the detergent arch shall allow immediate activation of the nozzles upon arch activation by the vehicle. All arch piping, structures, and anchors must be stainless steel.
 - g. Detergent arch(es) shall be supplied soft, heated water, heated by an electric water heater supplied as a part of the equipment package. Tank shall be sized at 100 gallons and unit shall be capable of producing 190 gallons of water at 100 to 120 degrees F per hour.
 - h. All detergent arch water shall be fresh water.
2. Brush System with Roof Mop:
 - a. The system shall be equipped with a counter rotating four-brush, minimum wash system in order to reach the door recesses and mirrors.
 - b. Brushes shall be controlled to automatically adjust the degree of brush pressure delivered to the bus to prevent damage to protruding objects such as mirrors. Should pressure become too high due to a malfunction or driver error, the system shall automatically shut down to prevent damage. The cause of the shutdown shall be indicated on a control panel. Reactivation of the system shall be achieved by resetting the alarm/breaker switch.
 - c. Two brushes shall be sized to wash the front of the bus and avoid damaging bike folded bike racks.
 - d. Two brushes shall be sized to wash the entire profile of the buses. Including the sides and rear of the bus. The rear wash follow-up of the brush shall be by separately adjustable air pressure only for the rear follow-up feature.
 - e. All brushes shall be able to be fixed side brushes should the Owner decide to wash front and rear of buses in future using high-pressure arches.
 - f. The brush system support structure shall be hot dip galvanized with stainless steel anchors.
 - g. The brushes shall be of Soft Foam Material known by trade names of

- Poly-Lite, Car-Lite or Neo-Tex.
 - h. The brush motors shall be designed for a wet environment.
 - i. The roof mop shall be supported by the same structure as brushes. The roof mop shall be designed as not to interfere with any mirrors or other protrusions of the buses.
 - j. All brush water shall be fresh water.
 - 3. Undercarriage wash system:
 - a. The system shall be designed with optimized high-pressure spray pattern to clean the vehicle under body.
 - b. Galvanized steel high-pressure pipe (minimum 9-feet in length) mounted perpendicular to vehicle travel direction. Minimum 8 stainless steel spray nozzles. Includes traffic-rated hot dip galvanized steel cover plate grate with cut-outs for pipe connections.
 - c. All high pressure water shall be reclaimed water.
 - 4. Final rinse arches:
 - a. The final rinse arches shall use fresh water processed through the Reverse Osmosis System (RO). There shall be two Arches. The first arch shall use reject water from the RO system. The second arch shall use RO water from RO water storage tank and shall be the spot free final rinse arch.
 - b. Timing of operation and position of the rinse arches shall be determined by manufacturer to provide optimum rinse penetration after wash cycle.
 - c. Final Rinse Arches shall be made of stainless steel pipe and equipped with dual, adjustable swivel nozzles and diaphragm check valves to evenly apply fresh water rinse to front, rear, sides and roof of vehicle proceeding through the arch.
 - 5. Reverse Osmosis (RO) System:
 - a. RO system shall be controlled on the main bus wash control panel touch-screen. The RO system electrical system design shall be based upon the hardness test of city water supply and shall produce water quality that will provide spot free, non-etching quality rinse water for bus wash systems.
 - b. RO system shall include the following as standard equipment:
 - 1) Water softener.
 - 2) Filters.
 - 3) RO water tank.
 - 4) Piping and connection between equipment shall be provided as required for complete an operable system.
 - c. Water softener:
 - 1) The water softening system shall be used as a pretreatment system prior to delivering water to the RO system.
 - 2) Water softening system shall reduce the hardness to less than 3 grains of hardness.
 - 3) Water softener shall be capable of handling a flow rate of required for the wash system at a continuous pressure of 50 PSI with a pressure

- loss not exceeding 15 PSI.
- 4) The system shall have a softening capacity of not less than 60,000 grains of softening capacity per regeneration when a salt dosage of 18 pounds per tank is used.
- 5) Resin tank shall be sufficient to allow adequate expansion of the resin during backwashing. Tanks shall be designed for an operating pressure up to 120 PSI.

- d. The single activated carbon filter shall be properly sized for the inlet flow rate of the RO assembly. The filter shall remove chlorine and prevent RO membrane damage. Automatic backwashing system removes the trapped contaminants within the filter and washes them down the drain.
- e. Cartridge pre-filter shall be attached at the inlet of the RO system. The filter shall be rated for 5 micron nominal. The filter housing will include a built in pressure relief valve to collect any particles larger than 5 microns.
- f. The pressure sensor at the inlet pump shall monitor the inlet pressure. If the flow drops below a certain value, it will cause the HP pump to stop. It will also trigger the inlet solenoid to stop the flow of water.
- g. The pressure sensor at the outlet pump shall monitor the system pressure. The sensor shall stop the HP pump if the system pressure rises above 250 PSI. The minimum operating pressure should be no less than 200 PSI.
- h. The inlet solenoid valve shall shut off/on the water supply to the RO system.
- i. A pressure gauge shall be provided to monitor the pump outlet.
- j. A pump throttle valve shall be included to control the pressure.
- k. A flow control valve shall control the concentrate at the outlet of the RO system. The valve along with the pump throttle valve should be used to adjust the systems pressure and flow rate of concentrate and permeate.
- l. The concentrate outlet solenoid valve open and closes during automatic flushes.
- m. The flow meter shall measure the flow of permeate and concentrate at the product and concentrate line. The flow meter shall be panel mount type with horizontal connection, ranging 1 to 10 GPM.
- n. The high pressure pump will be used to produce an operating pressure of 230 PSI at the inlet of the RO membrane.

6. Water reclamation and treatment system:

- a. The water reclamation system shall be capable of reclaiming water from the vehicle washer and process it by means of settling pits, in-line filters, centrifugal filter system and bio-remediation system. The system must be able to continuously supply adequate amount of water for high-pressure pump regardless of traffic volume through the washer.
- b. The above ground tank or tanks shall be of self-cleaning type and designed not to accumulate any dirt build-up.
- c. Bio-Remediation system shall be included in total system design. The bio-remediation system shall be designed to eliminate and/or reduce the total load of hydrocarbon loading within the recycled water body. The system shall include and consist at least the following components:

- 1) Enzyme dispensing system.

- 2) Accelerator dispensing system.
 - 3) Dissolved Oxygen Aeration system.
- d. The odors must be kept in total control without the use of any chemicals. The guarantee that the system is built to control odors must remain valid after the final acceptance for the period of three years. Algae build-up in wash water that will result in objectionable odors is not acceptable to the Owner.
- e. Sump pump:
- 1) Self-priming type for transferring water from sump pit to the above ground recycled water tank through the filtration system. Minimum capacity shall be 300 GPM of cleaned water.
 - 2) The capacity of sump pump shall allow for the pressure losses from two cyclone separators used in series and GPM after the pressure losses shall be higher or equal to the high pressure wash water usage.
 - 3) The sump pump shall be designed to handle solids that will be found in wash water.
- f. Cyclone separators:
- 1) Two cyclone separator systems shall be used in series, the cleaned water from the first cyclone shall pass through the second cyclone separator to ensure maximum solid removal performance. Two cyclone separators shall be provided in series with at least one of them being in-line.
 - 2) Cyclone Centrifugal Separators shall provide second and third stage filtration.
- g. Downflows (purge water from cyclone separators containing solids) from cyclones separators shall pumped back to the exit end of the trench pit with a solid handling pump. The solid removal pumping shall be activated when cyclone separators need to be purged.
- h. The aeration system shall provide air into the trench pit to prevent algae and odor build-up. Aerated water shall be evenly distributed throughout the pit even when the wash system is not operational. The system shall be designed to have no odors from algae.
- i. Stainless steel intake filter:
- 1) Stainless Steel Intake Filter Screen shall provide first stage filtration for sump pump intake. The pump intake filter shall be sized 0.015 inch or smaller.
 - 2) The intake filter shall made of stainless steel and shall have slotted orifices. Intake filter shall prevent any dirt from clogging the recycled water spray nozzles under all circumstances.
 - 3) Intake Filter Screen shall be equipped with high-pressure air back wash system that is automatically activated by the reduced flow into the pump intake.
- j. Reclamation tank:

- 1) Reclamation Tank shall be made of linear low-density polyethylene with a minimum holding capacity to allow recycling a minimum of 300 GPM continuous operational flow.
- 2) The tank shall have a 6 inch bottom manhole, float switch connections and other required fittings.

k. Enzyme-catalyzed water treatment system:

- 1) A biological water treatment system shall be included in total system design. This water treatment system, the enzyme-catalyzed water treatment system, shall be designed to eliminate and/or reduce the total petroleum hydrocarbon loading within the recycled water body. When used in conjunction with the specified recycling equipment, the systems shall remove both organic contaminants and inorganic particulate from the reclaimed water stream.
- 2) The Enzyme-Catalyzed Water Treatment System shall be equipped with an automatic product injection system for delivery of specialized biological products and enhancements. These biological products shall be specifically suited for wash water treatment applications, including degradation of petroleum hydrocarbon components commonly found in vehicle wash systems. This system will treat the reclaim wash water generated during the vehicle wash process. The bulk of the treatment process shall take place in the wash water pit, where continuous biological treatment of organic wastes in the vehicle wash water shall occur.
- 3) The Enzyme-Catalyzed Treatment System shall deliver a constant supply of biological products, bio-enhancements, and oxygen to support degradation of organic constituents. The biological products and enhancements shall be injected directly into the circulation/aeration discharge pipeline of the recycling system, where they will then subsequently be discharged into the wash water pit. Oxygen shall be provided by the aeration pumping and mixing system.
- 4) The automatic product injection system shall consist of low-flow injector pumps that inject biological products on a continuous basis. The injector pumps shall have:
 - a) Operating temperatures between 35 to 110 degrees F.
 - b) Product flow rate - 0.5 to 1.5 liters per day, adjustable.
 - c) Product delivery - Up to 10 feet of 3/8 inch diameter polyethylene tubing.
 - d) Two polyethylene check valves.
 - e) Two compression fittings.

7. Speed control:

- a. The Traffic lights shall be contained in a watertight enclosure and are DOT approved.
- b. Provide minimum two speed control devices at the following positions:
 - 1) Near the beginning of the wash to indicate the bus may enter the

- wash bay.
- 2) A traffic light visible to the driver must indicate separately on each side and only for the period of time while each brush moves across the rear of the bus.

8. Tire guides:

- a. Tire guides shall be made of minimum 4-inch, Schedule 40 hot dip galvanized pipes.
- b. The system shall have angled entry at the entrance. Ends of rails are capped and all headings are smoothly finished to prevent tire damage. Brackets supporting pipe shall be made of minimum of 3/8 inch steel plate that are welded to concrete imbedded cleats or anchor bolted to the concrete.
- c. The system shall have stainless steel skid plates to allow misaligned bus to slide sideways for proper positioning.

9. Noise:

- a. Wash equipment shall not exceed 60 dbA at the lot line of adjacent properties.

F. Controls:

1. The industrial Program Logic Controller (PLC) component is used as the HMI and process controller for proposed components and future vehicle wash systems. The application software provides near-real time control of the entire wash system. The PLC is connected to distributed I/O using ethernet network.
2. The Process Controller (PC) shall be panel mounted onto the electrical enclosure, which also houses the electrical controls for the wash system. The PC may be mounted in its own enclosure in an office environment. The PC provides the centralized infrastructure to enable simple and complete integration with other systems, including modems, point-of-sale LANs, video, wireless internet, smart card readers, and other systems not yet developed.
3. The application software shall be developed and provided by the manufacturer. This software shall include the specified bus wash components and cover all future expansions. The application software shall be written either for Linux or Windows-based systems. The wash software shall provide the following:
 - a. GUI shall be intuitive to use by people without computer experience.
 - b. At program start up, all devices shall be initialized to a known state.
 - c. All system settings, such as baud rates, parity, comm. port configurations, etc. shall be reconfigurable without necessitating recompiling the application software.
 - d. All user configurable settings shall be stored to disk using *.ini files, the windows registry, or a database to remember settings between reboots. These include all timing set points, alarm settings, and communication settings.
 - e. Data being logged to disk shall be buffered and only physically written to disk periodically to prolong the life of flash/hard drive.
 - f. Alarms should have user configurable delays to prevent nuisance tripping.

All user actions shall be logged to disk with a time and date stamp. User actions include timing changes, putting the system into auto/manual, changing options, or powering the system up/down.

- g. Periodic polling of I/O may be initiated by either hardware or software interrupts. All real time processes, such as those required for closed loop control, shall be hardware interrupt driven.
 - h. A hardware watchdog circuit shall be used in case the PC locks up. Minimum timeout shall be 10 seconds. This circuit will be in series with the E-stop circuitry.
 - i. Error handling shall be provided for each and every line of code. It is not necessary to alert the user of all errors, but all handled errors shall be logged to disk.
 - j. Alarms shall have user configurable delays to prevent nuisance tripping.
 - k. Latency: scanning interval for all closed loop processes shall be executed less than 500 ms.
 - l. Provide terminal windows for spying on any devices communicating to PC via Ethernet, RS232, etc. These shall be used for troubleshooting communications problems.
 - m. Failure of any single component shall result in disabling the entire wash. For example, the system shall not be allowed to wash vehicles in a crippled state if a chemical pump motor overload trips.
- 4. The Industrial Control Panel shall be manufactured and evaluated in accordance with the Underwriters Laboratories, Inc. (UL) standard 508A (Industrial Control Panels). In addition, the panel shall be evaluated for high-capacity short circuit withstand and shall bear the appropriate UL marks including the short circuit withstand value mark as part of the official UL label.
 - 5. The industrial Control Panel shall be designed for operation on a 460 VAC, 3 phase, 60 HZ system, with a short circuit capacity of 65,000 amperes RMS Symmetrical, available at the incoming line terminals of the control panel.
 - 6. The Industrial Control Panel shall be designed to meet the requirements of the National Electric Code (NEC) Articles 430 and 670, also the National Fire Protections Association (NFPA) Standard 79 (Industrial Machinery).
 - 7. All push buttons, selector switches, pilot devices, system control and access functions shall be by Touch Screen Operator Interface Terminal.
 - 8. The main control box shall include a control panel with an LCD Touch Screen to provide the following standard functions:
 - a. Front, Sides and Rear Wash for Buses with Bike Racks (complete wash).
 - b. Sides and Rear Wash.
 - c. Sides only Wash.
 - d. Brushes 1 & 2 Off/On.
 - e. Brushes 3 & 4 Off/On.
 - f. Drive Through Without Wash.
 - g. Detergent Arch Off/On.
 - h. Chassis Wash Off/On.
 - i. High Pressure Arch Off/On.
 - j. Alternate Wash Programs.
 - k. Emergency Stop.
 - l. Emergency Stop Reset.

9. Electric Panels that are not UL approved shall not be acceptable.
10. The activation switches shall be designed to be activated by all fleet vehicles used by the Owner. Each activator shall be pre-mounted and wired to a watertight junction box equipped with built-in drainage holes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine floors and bases for suitable conditions where vehicle wash equipment will be installed.
- C. Examine walls and ceilings to which vehicle wash equipment will be attached for properly located blocking, grounds, or other solid backing for attachment of support fasteners.
- D. Examine roughing-in for utility services and interconnected controls to which vehicle wash equipment will be connected for proper location and required type.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Vacuum and clean finished floor over which vehicle wash equipment, of type covering floor, is to be installed.

3.3 INSTALLATION

- A. Install vehicle wash equipment according to manufacturer's written instructions and, if applicable, approved shop drawings. Unless indicated otherwise install equipment level, plumb, square, rigid, and true. Install free of dents or distortion. Make connections to form a rigid structure, free of buckling and warping.
 1. Install equipment anchored to substrate unless indicated otherwise.
 2. Install braces, straps, plates, brackets, and other reinforcements as needed to support equipment loading and as required for stability.
 3. Anchor equipment using fasteners of type recommended by equipment manufacturer.
 4. Connect equipment to utilities specified.
 5. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
 6. Seismic Restraints: Install seismic-restraint devices using methods approved by preapproved ratings submittal, independent testing submittal, or delegated design submittal provided for each vehicle washing equipment type.

- B. Arrange equipment so controls and devices are accessible for servicing.
- C. Arrange equipment so that piping can be installed a required slope.
- D. Install equipment with access and maintenance clearances that comply with manufacturer's written installation instructions and with requirements of authorities having jurisdiction.
- E. Fill equipment reservoirs and tanks with manufacturers recommended brand of cleaning chemicals (soap and other solutions) required for equipment operations.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform following field tests for each vehicle wash system.
 - 1. Vehicle Wash and Dry Test:
 - a. Consecutively wash and dry 5 vehicles of Owner's choosing in a time period not exceeding 15 minutes.
 - b. Washing and drying operations shall be conducted without the need of assistance by Owner's personnel (other than driver of vehicles), Contractor, Manufacturer's Representative, or others.
 - c. Vehicles must exit the system substantially dry. No more than **[10%]** **[20%]** of wash water may leave wash bay to reduce puddling.
 - d. Equipment shall not damage vehicles, including mirrors, windshield wipers and windows. Should damage occur, contractor shall compensate Owner for repairs.
 - e. Equipment shall not become damaged during washing and drying operations.
 - 2. Water Reclamation System Test:
 - a. Manufacturer's Representative shall continuously operate the water reclamation system for 60 minutes with the vehicle wash system active. During that time:
 - 1) No manual adjustments or overrides are allowed.
 - 2) No solenoid shall be allowed to fill the reclamation tank with fresh water should the sump pump be unable to keep the recycled water tank full.
- C. Vehicle wash equipment will be considered defective if it does not pass tests and inspections.
 - 1. Equipment failing tests shall be corrected within 5 days and re-tested.
 - 2. Equipment failing a second test shall be corrected within 5 days and re-tested.

3. Equipment Failing Third Test: Owner reserves right to have defective vehicle wash equipment and associated water reclamation system removed from site at no cost to Owner.

D. Prepare test and inspection reports.

E. Adjust controls and safeties if required. Replace damaged and malfunctioning controls and equipment.

3.5 CLEANING AND PROTECTING

A. Clean finished surfaces and make ready for use. Remove residual oil, grease, solvents, and other contaminants using methods and products that will not damage equipment surfaces.

B. Touch up marred finishes or replace vehicle wash equipment that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by vehicle wash equipment manufacturer.

C. Replace vehicle wash equipment components that have been damaged beyond successful repair by finish touchup or similar minor repair procedures.

D. Protect installed products from damage during remainder of the construction period.

3.6 DEMONSTRATION AND TRAINING

A. Engage a factory-authorized service representative to demonstrate operation of vehicle wash equipment to Owner's designated personnel.

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the following vehicle wash equipment:

1. Bus washer: 8 hours minimum.

END OF SECTION 11 11 26

SECTION 12 24 13 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Manually operated roller shades with single rollers.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
- C. Samples: For each exposed product and for each color and texture specified, 10 inches long.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roller shades to include in maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than one unit.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.08 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.02 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Draper Inc.
 - 2. Hunter Douglas Contract.
 - 3. MechoShade Systems, Inc.
 - 4. Nysan Solar Control Inc.; Hunter Douglas Company.
 - 5. OEM Shades Inc.
- B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Nickel-plated metal .
 - a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Clip, jamb mount .
 2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.
 - a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criteria are more stringent.
- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
1. Roller Drive-End Location: In location recommended by fabricator. Indicate location for each shade on submittal for Architect's review.
 2. Direction of Shadeband Roll: Regular, from back of roller.
 3. Shadeband-to-Roller Attachment: Removable spline fitting integral channel in tube.
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Shadebands:
1. Material Orientation on Shadeband: Railroaded.
 2. Material: .
 - a. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
 - 1) Source: Roller-shade manufacturer.
 - 2) Type: PVC-coated polyester.
 - 3) Weave: Basketweave.
 - 4) Roll Width: To match window width plus 2 inches on each side.
 - 5) Openness Factor: 3 percent.
 - 6) Color: As selected by Architect from manufacturer's full range.
 3. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- F. Installation Accessories:

1. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.03 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
 1. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:
 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
 2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
 1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

3.03 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.04 CLEANING AND PROTECTION

- A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 24 13

SECTION 23 12 17 - DIESEL FUEL DISPENSING SYSTEM

PART 1 - GENERAL

- 1.01 Scope of Work. This section applies to the dispensing equipment, piping and installation methods for the diesel fueling station as shown in the drawings. Equipment covered in this section includes the submerged centrifugal pump, and all downstream dispensing equipment, including associated piping, valves, sump, dispenser, hoses, hose support, and nozzle.
- 1.02 RELATED SECTIONS
- A. Section 23 13 23 "Aboveground Fuel Storage Tank System
 - B. Section 28 34 01 "Petroleum Leak-Monitoring System .
 - C. Other project documents as required per contract.
- 1.03 REFERENCES
- A. General. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
 - 1. American Petroleum Institute (API)
 - a. API Spec 5L (2004) Line Pipe Section 15193N Page 3
 - 2. ASME International (ASME)
 - a. ASME B16.11 (2011) Forged Fittings, Socket-Welding and Threaded
 - b. ASME B16.15 (1985; R 2004) Cast Bronze Threaded Fittings Classes 125 and 250
 - c. ASME B16.21 (2011) Nonmetallic Flat Gaskets for Pipe Flanges
 - d. ASME B16.5 (2009) Pipe Flanges and Flanged Fittings: NPS 1/2 through 24
 - 3. ASTM International (ASTM)
 - a. ASTM A53/A53M-04a Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - b. ASTM A106/A106M-04b Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
 - c. ASTM D975-04 Standard Specification for Diesel Fuel Oils
 - 4. Manufacturers Standardization Society Of The Valve And Fittings Industry (MSS)

- a. MSS SP-80 (2003) Bronze Gate, Globe, Angle and Check Valves
- 5. International Code Council
 - a. International Fire Code (2011) with State of New Mexico and City of Taos amendments.
- 6. National Fire Protection Association (NFPA)
 - a. NFPA 30 (2012) Flammable and Combustible Liquids Code
 - b. NFPA 30A (2012) Code for Motor Fuel Dispensing Facilities and Repair Garages
 - c. NFPA 70 (2011) National Electrical Code, with State of New Mexico and City of Taos amendments
- 7. Underwriters Laboratories (UL)
 - a. UL 330 (1996; Rev thru Feb 2000) Hose and Hose Assemblies for Dispensing Flammable Liquids
 - b. UL 567 (2003) Emergency Breakaway Fittings, Section 15193N, Page 4: Swivel Connectors and Pipe-Connection Fittings for Petroleum Products and LP-Gas
 - c. UL 674 (2003) Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations
 - d. UL 698 (1995; Rev thru Mar 1999) Industrial Control Equipment for Hazardous (Classified) Locations
 - e. UL 842(1999) Standard for Safety for Valves for Flammable Fluids
 - f. UL 886 (1994; Rev thru Apr 1999) Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations
 - g. UL 971 Nonmetallic Underground Piping For Flammable Liquids (July 2005)

1.04 SUBMITTALS

- A. General. Contractor shall submit shop drawings and equipment data for review and approval by the Engineer, in writing, prior to ordering.
- B. Shop Drawings. Submit shop drawings for the proposed dispenser. Shop drawings shall show overall dimensions, piping material and size, structural supports, valves, filters, breakaway fittings, pulsers, displays and wiring arrangement.
- C. ManufacturerTMs product data. Product data shall be submitted for the equipment listed below. Data shall include model numbers, materials of construction, features and design codes or standards used. Also provide the manufacturerTMs recommended installation procedures. Where data include several different products on one sheet, clearly mark the sheet to indicate which product(s) is (are) proposed. Furnish product data for the following items of equipment:
 - 1. Submerged centrifugal pumps
 - 2. Pump controllers

3. Pressure relief valves
4. External emergency valves
5. CS piping for fuel product and vent
6. Dispenser sump
7. Dispenser
8. Fueling hoses and nozzles

1.05 TEST REPORTS

- A. General. Contractor shall furnish the following reports prior to project completion.
1. Pneumatic tests of product piping
 2. Leak detection monitoring system test
 3. Operational test

1.06 REQUIRED OPERATION AND MAINTENANCE MANUALS

- A. General. General. Contractor shall furnish the following manuals prior to project completion.
1. Pumps
 2. Pump controllers
 3. Dispensers
 4. Power/relay panel

1.07 QUALITY ASSURANCE

- A. Standard Products. Material and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of the products. Materials shall be resistant to ULS diesel and biodiesel blends of up to B20. The completed installation shall conform to applicable requirements of NFPA 30 and NFPA 30A.
- B. Permitting. Contractor shall obtain necessary operating permits in conjunction with installation of underground petroleum piping as may be required by federal, state, or local authority. Submit copy of permits to the Contracting Officer.
- C. Contractor Certification.
- D. The contractor performing the work specified herein shall be certified by the Indiana Public Works Certification Board to construct Public Works. The contractor shall have Special Trade certification in Plumbing and Electrical work
- E. Safety. Ensure employees are trained in requirements of 29 CFR 1910.1200 and understand information contained in material safety data sheets for their protection against toxic and hazardous chemical effects.

- F. Warranty. The contractor shall warrant that the products, materials and workmanship provided are without defect for a period of 1 (one) year, following the date of owner™s acceptance of the facility as being complete. Contractor shall repair any defects discovered during the warranty period at no cost to the Owner.

PART 2 - PRODUCTS

2.01 SUBMERGED CENTRIFUGAL PUMPS FOR DIESEL

- A. General. Provide one submerged centrifugal pumps with 0.75 HP, 1-phase motor, for dispensing diesel fuel. Motor shall be fed by 208V 60HZ supply. Pump starters shall detect abnormal motor conditions, including stalling, overheating and excessive current draw, and interrupt motor power when detected.
- B. Approved products. All petroleum pumps provided to the site shall be the products from a single manufacturer. The following products are approved. No substitutions will be allowed:
1. FE Petro STP-AGLRV-075
 2. Or equal Red Jacket 0.75 HP pump.
- C. The entire pumping assembly shall have a UL listing for Group D, Class 1 Flammable solvents. The pump motor windings shall be hermetically sealed against leakage of product or moisture into the motor.
- D. Description. The pump shall install through a standard 4" NPS Schedule 40 tank opening. The pump shall use a 1-phase line frequency motor suitable for line-to-neutral voltages between 200 and 240 VAC.
- E. The pump discharge opening shall be a 2" NPS female NPT.
- F. The pump shall be equipped with a variable telescoping length feature, allowing the pump length to be adjusted in the field without disturbing the UL label.
- G. The pump motor shall have a thermal over-current overload protector with automatic reset.
- H. The pump motor assembly shall be clearly marked with pertinent information including Model, Horsepower, Voltage, Phase, and Manufacturer etched into the pump shell for permanent identification.
- I. The pump shall be UL listed for the following products:
1. 100% Diesel fuel
 2. B20 Diesel fuel
 3. 100% ULR gasoline
 4. 85% ethanol gasoline (E85)
 5. Gasoline-oxygenate blends of 20% ETBE, or 17% TAME

- J. The pumping unit shall not incorporate any flexible diaphragms. All sealing shall be accomplished with Viton O-rings or UL recognized fiber gaskets.
- K. The pump shall be rated to operate between -40°F (-40°C) and 104°F (40°C) with the specified products.
- L. The pump shall have an air/vapor elimination system that returns air or vapors to the underground storage tank through a tube discharging near the top of the pump motor assembly.
- M. The pump unit shall contain a built-in expansion relief valve that relieves pressure at or above pumping pressure but below 50 psi as standard. Other pressure relief settings shall be available.
- N. The pump motor shall utilize the product being pumped for lubrication of the motor bearings and for cooling the stator, and this fluid shall discharge into the underground storage tank at the top of the motor.
- O. The pump head shall have a 2" NPT threaded opening for the installation of mechanical line leak detectors or pressure transducers used in certain electrical line leak detectors.
- P. The submerged centrifugal pumps shall incorporate the following features to facilitate maintenance:
 - 1. The pump shall incorporate a port for line pressure testing that shall be sealed with a 1/4" NPT pipe plug.
 - 2. The head of the pump shall contain a manual pressure relief screw to bleed static line pressure to zero through a flow path into the tank. This feature is required to avoid product escaping into the environment when opening the piping system for service when the piping is pressurized.
 - 3. The pump unit shall have a fully extractable head in order to permit removal of the pump motor assembly without disturbing the discharge piping, product in the pipelines downstream of the check valve, siphoning system with siphon check valve installed, or the electrical wiring.
 - 4. During the removal of the extractable portion of the pump, product contained in the discharge manifold of the pump shall drain automatically into the storage tank.
 - 5. The product in the pipelines shall be held in place by a line check valve that shall have a minimum sealing force of 170 lbs. (77 kgs) when the pump is not running and a minimum 30 psi of pressure in the pipeline.
 - 6. The line check valve shall be independent of the removable head and shall be easily accessible.

2.02 PUMP MOTOR CONTROLLERS

- A. The pumps shall operate with a full-voltage, non-reversing (FVNR) line frequency controller suitable for use with the specified pump. The controller(s) shall be designed for controlling two pumps discharging to a common manifold, with the capability of starting one or two pumps as needed to supply the full rated product flow rate through each hose that is in use. The flow rate at fueling nozzle at the fleet island shall be between 25-30 gallons per minute (GPM). These flow rates shall be maintained with any number of nozzles active.
- B. The pump controller shall automatically detect abnormal conditions that could cause pump or motor malfunction or damage. The controller shall report and distinguish the following abnormal operating conditions by means of displays on the face of the controller, or by connection to a computer through a communications port.
 - 1. Tank Empty, Under-load
 - 2. Low Incoming Voltage
 - 3. Locked Rotor
 - 4. Open Circuit
 - 5. Capacitor Bank Failing
 - 6. Extended Run
 - 7. Short Circuit
 - 8. High Motor Temperature.
- C. Manual Reset Button. The controller shall be equipped with a manual reset button, which is pressed upon correction of any of the above faults.
- D. Status display. The front cover of the controller shall have a display to indicate power on, pump running, and abnormal conditions.
- E. Pump Controller Configuration: One controller is required for each pump. A total of (1) diesel pump controller will be integrated into the "PPS1™" panel. The controllers shall be wired separately and independently, to allow simultaneous dispensing of each product. This configuration will allow the control system to start up any combination of pumps, depending on demand. The controller shall alternate the first pump running every time fueling activity starts from an intermission.
- F. The pump controllers shall operate on a 208V, 60 HZ, 1-phase line. Input and output wiring of controller shall be "home-run" rigid metal conduits, with no shielded power cables required.
- G. The relay/hook signal used for pump start/stop control shall be 120V, 60 HZ, single-phase.
- H. The controller shall have an RS 485 communications port for connection compatibility to electronic line leak detection/point of sale units manufactured by others, or other PC monitoring means.
- I. Acceptable pump controllers.

1. FE Petro STP SC-I Smart Controller, manufactured by the Franklin Fueling Systems.
2. Or Red Jacket IQ Pump Controller (match pumps).

2.03 ABOVEGROUND VENT AND FUEL PRODUCT PIPING

- A. Aboveground normally wetted by fuel product shall be seamless carbon steel manufactured according to ASTM A106, Grade B, Schedule 40 sized per drawings.
- B. Aboveground vent piping shall meet the specification given above for wetted product pipe.
- C. Threaded Pipe Fittings. Threaded steel pipe shall be joined using ANSI/ASME B16.11 Class 2000 forged steel fittings.
- D. Threaded Joints: Threaded joints must be reamed and have clean-cut, perfect threads and be made up with non-hardening joint compound insoluble in petroleum products. Approved joint compounds include Rectorseal True Blue, Hercules Real Tuff, and Permatex High Temperature Thread Sealant.

2.04 UNDERGROUND FUEL PRODUCT PIPING

- A. Not used.

2.05 DISPENSER CONTAINMENT SUMPS AND ASSOCIATED EQUIPMENT

- A. General: Furnish a single-wall, steel dispenser sump and mounting flanges for outdoor fleet dispenser. Use the dispenser sump manufacturer™s recommended transition fitting between underground piping and in-sump piping. Install NPS 1.5 braided stainless hoses between transition fittings and emergency (shear) valve for fuel product lines. Attach emergency shear valve to stabilizer bar, using a mounting boss. Connect shear valves to dispenser inlets with NPS 1.5 Schedule 40 pipe nipples.
- B. Dispenser sump shall be fabricated from stainless steel, and equipped with a galvanized steel mounting frame with rain lip, concrete anchors and an adjustable stabilizer bar.
- C. Dispenser sump shall be by S. Bravo Systems.
- D. Product line line flex hoses shall be Fireflex FRP, equipped with an EZ FIT connector to a NPS1.5 male pipe tread fitting connected to the emergency (shear) valves.
- E. Emergency product (shear) valves shall have NPS 1.5 female top and bottom fittings, air test port, be boss-mounted and be equipped double poppets. Provide OPW. Model 10 Plus 10P-0152.

2.06 DIESEL DISPENSER

- A. General. Provide (1) 1-hose single-product dispenser. Dispenser shall be designed for use with remote pump. Each nozzle shall have a switched nozzle rest, functioning as a hook switch, and deliver a flow rate of 30 gallons per minute per nozzle, with the associated equipment specified herein. Nozzle rests shall be lane-oriented. Furnish dispenser with factory-supplied hose mast.
- B. Approvals. Dispenser shall be listed by UL.
- C. Registers. Display registration shall be electronic, using backlit LCD display. Provide a separate mechanical totalizer on each dispenser, as well.
- D. Flow meter and Totalizer: Dispenser shall be equipped with a Wayne Intelligent iMeter. Display registration shall be electronic.
- E. Other Requirements. The following additional features or equipment shall be provided for each dispenser:
- F. Display register designed for 115 VAC, 60 HZ service.
- G. Equipped with internal adapters for product filters.
- H. Stainless steel panels for front, back, top and side surfaces.
- I. RS485 interface for communication with fuel management system.
- J. Selectable pulse or gallon outputs to the fuel management system.
- K. Fluorescent luminaries for illuminating the display panels.
- L. Hose retractor. Provide integrated ~flex tee™ hose mast.
- M. Pulse output to fuel management and monitoring systems.
- N. For each diesel nozzle, provide one 1 inch by 14-ft hose equipped with breakaway and swivel; Goodyear Veyance Flexsteel hose, in-line Husky model 3360 breakaway, and 1• OPW nozzle; or equal. Coordinate nozzle scuff guard color with owner.
- O. Approved Model. All dispensers shall be the identical products of a single manufacturer. Approved products are listed below.
- P. . Wayne Select, series model 3/G7231D/GHJY1/JVW4.

2.07 FUEL MANAGEMENT

- A. General. Provide one terminal at fueling island and connect to (1) single-hose single-product fleet dispenser.

- B. Performance Requirements.
- C. Each single-product fleet dispenser shall be configured and wired to the fuel management terminal so that the terminal limits the dispensing of fuels to authorized transactions. Dispenser solenoid valves shall remain closed until authorized to open by the fuel management terminal.
- D. Fueling authorization shall be achieved by keypad entry, proximity card and mag card. Terminals shall record the volume of fuel dispensed at each service lane by reading and recording pulses generated by the respective product dispensers. All fueling records shall include employee ID number, date, time of day, vehicle ID number, fuel fill volume, odometer reading, and product reel volumes.
- E. Installation requirements:
- F. All conduit and wires between the fuel management terminals and other connected equipment shall be installed in PVC-coated rigid-galvanized steel. This includes AC power to the fuel island terminals, data wiring between the terminal and the DED panel in the electrical room, 120 VAC control wiring and low-voltage pulser wiring between the terminal and dispensers. All low-voltage pulser wiring shall be installed in a dedicated conduit.
- G. Final Terminations. Final terminations and hookups of terminal wiring and initialization of terminals shall be performed exclusively by personnel trained and authorized by the fuel management system supplier.
- H. Approved fuel-management terminal model:
- I. EJ Ward / model W4.

2.08 PETRO POWER DISTRIBUTION PANEL

- A. General. Provide shop-fabricated power distribution and control panel for powering fuel-product pumps, dispensers, and fuel-management terminals. to automatically disconnect power, emergency shutdown, switched neutral, hook-switch isolation, external ESD relay (normally closed), and 100KA/phase TVSS protecting all power feeder circuits.
- B. Power Requirements. UL-listed assembly equipped with min. 70 A 3-pole main circuit breaker and branch circuit breakers; pre-configured for power to each of:
- C. 208 VAC/ 1-phase breaker for .75 HP diesel pump
- D. (3) 120V 15A breakers for: dispenser power, fuel-management terminal and leak-monitor console
- E. 120V ESD circuit power
- F. (2) spare 120V 30A convenience-outlet circuits.

- G. Provide with lockable NEMA 4 enclosure.
- H. Features. Panelboard shall include:
 - I. Hook-switch isolation.
 - J. TVSS for all circuits.
 - K. Switched neutral for all circuits.
 - L. ESD relay, wired 120V normally closed.
 - M. Low-Voltage Isolation.
 - N. Include isolation and lock-out for low-voltage wiring between diesel dispenser and the fuel-management terminal, including pulse and communication wiring. Provide dispenser equipment disconnect (DED) panel by Carolina Products or approved equal, and either integrate with main PPS1 panel or package as separate module.
 - O. Dispenser Equipment Disconnect. Automatically disconnect low-voltage and communication circuits on dispenser island upon ESD event. Includes circuits for product pulsers and Ethernet communication. Also provide manual disconnects with lock-out ability. DED panel shall be UL listed, and housed in NEMA 4 enclosure. Configure for (2) two-hose dispensers. DED panel or module may be integrated with petro-power panel or may be provided in a standalone cabinet.
- P. Acceptable products:
 - Q. Petro Power Panel-1 by Carolina Products, Inc.
 - R. Power Integrity
 - S. Or approved equal.

PART 3 - EXECUTION

3.01 HANDLING OF PIPE AND FITTINGS

- A. Steel Pipe and Fittings: Protect against damage to the protective coating or wrapping, if present.
- B. Installation Requirements: Interior surface of all pipe and fittings must be free from dirt, scale, metal, fiberglass particles, etc., before connecting.
- C. Product piping shall be installed in accordance with the manufactures installation instructions and must slope uniformly from dispenser sumps to transition sump. Traps or sags will not be permitted. Group all piping and locate as shown on the plans. Lines are to be laid straight in a uniform manner.

3.02 CUTTING OF PIPE

- A. Steel Pipe: Cut with hand or power operated pipe cutter, as in normal fitting practice.
- B. Steel Pipe ends shall be reamed and deburred.
- C. Fiberglass pipe tapering: All cut fiberglass pipe ends must be tapered using one of the tapering tools available from the pipe manufacturer. Consult pipe manufacturer's instructions.
- D. Special Fittings: The shut off valve (shear or safety valve) at the base of the product dispenser is to be secured in position with a steel stabilizer.
- E. Position the valve so that the line test port plug is accessible.

3.03 PIPE WRAPPING

- A. All underground steel pipe and fittings shall be field primed and wrapped. Wrapping material shall be 35 mil. polyethylene tape "Polyken 930" manufactured by the Kendall Company. Overlap pipe wraps by 50% with no voids or wrinkles.

3.04 FIELD ASSEMBLY OF FRP PIPE

- A. Assemble piping in accordance with the manufacturer's written instructions and installation procedures, as approved by the Engineer.
- B. Personnel assembling FRP pipe shall be trained and certified by the pipe manufacturer, or the manufacturer™s authorized distributor. Contractor™s personnel shall provide evidence of certification upon the Owner™s request.
- C. Inspection. Prior to preparation and assembly, the Contractor shall inspect pipe for physical damage and make repairs in accordance with the manufacturer's written instructions, except over wrapping the damaged or faulty area with any type patch or other material will not be permitted. Remove and replace any damaged or faulty sections of pipe.
- D. Primary FRP Joint Preparation. Sand surfaces to be bonded, including those formed or shaved at the factory, not more than 2 hours prior to assembly. Clean and remove sanding dust to obtain surfaces suitable for bonding. Sanded surfaces that come in contact with hands, equipment, or dirt must be re-sanded. Dry and re-sand damp or wet bonding surfaces as required by the manufacturer.
- E. During rain or cold weather, prepare joint and assemble under a protective cover with heat applied. Pipe ends cut in the field shall be square within 1/16 inch for all diameters.

- F. Form spigot ends using tools recommended by the manufacturer. Align and fit prepared joints prior to application of adhesive.
- G. Adhesive mixing and application. Adhesive materials, mixing, and application shall be in accordance with manufacturer's instructions, including limitations on adhesive shelf life and pot life.
- H. Pipe assembly and alignment. Assemble FRP pipe and fittings according to manufacturer's instructions. Proper alignment must be maintained during assembly so that twisting or straightening is not required after joining. Misalignment shall not exceed 1/16 inch or one degree prior to application of adhesive.

3.05 CURING

- A. General. Cure FRP pipe joints and fitting joints according to the manufacturer's instructions. Heating devices shall be as recommended by the FRP pipe manufacturer. Do not move, vibrate, or otherwise disturb joints during curing of adhesive.

3.06 CONNECTIONS TO METAL PIPE

- A. Use flexible stainless steel connectors between FRP pipe and metal pipe, with the metal pipe anchored within 5 feet from the connection. Do not transmit expansion and load forces of metal piping to the FRP pipe. Make metal pipe to FRP connections in transition sumps having continuous leak monitoring.

3.07 UNDERGROUND PIPE SLOPE

- A. Refer to the Drawings. Slope horizontal buried fuel piping, unless otherwise indicated, with a downward grade of not less than 1/4 inch per foot of run from dispenser sumps toward the UST sump.

3.08 FRP PIPE INSTALLATION

- A. Pipe Assembly. Visually inspect the inside of each length of pipe to ensure that it is clear and clean prior to installation. Not more than 40 foot lengths of FRP pipe may be assembled over or beside the trench. Assemble greater lengths in the trench. Assemble outside the trench on timbers with the pipe blocked to hold alignment. Lower pipe into the trench in accordance with the manufacturer's recommendations. Lowering operation shall not move or disturb FRP pipe where joints are being assembled and cured. Block and support FRP pipe assembled in the trench with bedding to hold alignment.

- B. Bending of fiberglass reinforced plastic pipe. Limit bending of pipe to follow ditch contours to long trench curvatures, and do not permit abrupt changes in pipeline direction. Bending radii shall not be less than shown in the manufacturer's installation instructions. Avoid bending pipe with tees or laterals, as bending moments create undesirable stresses on bonded joints and fittings.
- C. Open Ends of the Pipe System. Close the open ends of the pipe system at the end of each day's work or when work is not in progress and keep closed until work is resumed.
- D. Pipe flushing. Prior to hydrostatic or pneumatic testing, flush the FRP pipe system with water until piping is free of dirt and foreign matter.

3.09 FIELD INSPECTION AND TESTS

- A. Field Inspections. Prior to initial operation, inspect piping system for conformance to drawings, specifications, and manufacturer's submittals.
- B. Furnish everything required for performing inspections and tests. Correct defects and repeat the respective inspections and tests.
- C. Test procedure: Prior to application of test pressure, remove or valve off piping components which may be damaged by the test and install a currently calibrated test gauge in the system. Maintain test pressure for time periods specified. In the event of leakage, locate and repair the leak(s) and repeat test.
- D. Piping Test. Before backfilling a pipe trench, perform pneumatic test of product and vent piping with air. Use a soap solution at joints to detect leaks. Test primary pipe, and arrange for witnessing of tests by local Fire or Building authority.
- E. The Contractor is responsible for all labor, materials, and equipment to conduct pressure tests (air or hydrostatic) of all product and vent piping.
- F. First Test (prior to backfilling pipe trenches): Do not connect piping to tanks, remote pumps or equipment.
- G. The entire piping system (i.e. product, vent) shall be tested in accordance with the following three-step procedure.
- H. Step One: Protect area around piping stems to be tested to prevent workmen , passer-by, etc., from entering. Install pressure application system that includes two pressure gauges (150 psig maximum). Apply 100 psig pressure to each piping system, hold for one (1) minute, release pressure, repeat for five (5) cycles.
- I. Step Two: Install pressure application system including two (2) pressure gauges (15 psig maximum). Apply 10 psig pressure to each piping system. Soap joints using approved soap solution. Carefully observe each joint for evidence of leaks.
- J. Step Three: Repeat Step One. Engineer's witness of all tests is required.

- K. Second Test (after connecting piping to tanks but prior to backfilling): Apply low pressure air (or hydrostatic) test to system as described in Post Installation Tank Pressure Test in Section 13216.
- L. Third Test (after backfilling and paving): Applies to product lines after backfilling, concrete, curbs, slabs, and yard paving has been completed.
- M. Test Gages. Use pressure test gages certified as being accurate to within one percent of their full scale. Use gages with maximum scale between 1 ½ and 2 times the test pressure.

3.10 FIELD REPAIRS OF PIPE AND JOINTS

- A. The Contractor shall be responsible for the repair of all leaks or other deficiencies caused by faulty workmanship or materials. Make repairs to leaking pipe or joints, whatever the cause, by removing and replacing the faulty section or a short length containing the fault. Over wrapping the fault with any type of patch or other material will not be permitted. If a joint is damaged during the laying operation, it can be cut off and a coupling bonded to the cutoff end and laid in the line as a normal pipe. If damage occurs to a pipe after it has been laid, the damaged section shall be cut out and replaced with a new pipe section in accordance with the manufacturer's instruction.

3.11 SETTING AND BEDDING PIPE

- A. FRP pipe shall be bedded on no less than 6" of pea gravel, with clast diameters between 1/8" and 3/4". Bedding shall be smooth and compact. Piping shall be placed on the prepared bed in such a manner as to minimize points at which one pipe may cross another pipe. At points where piping must crossover, a minimum of 1/2 pipe diameter must separate the pipes.
- B. When piping is placed on the bed, proceed to "first test" (described above) prior to backfilling trenches. Backfill with a minimum cover of 6" of pea gravel. Install bedding and backfill for electrical conduits above the product piping, as shown in the drawings. Restore trenched area to match adjacent grade and surface finish.

3.12 LABELING

- A. Major Equipment. The manufacturer shall provide a stainless steel or brass nameplate on each major item of equipment. The nameplate shall be mechanically affixed and shall be embossed with the manufacturer's name, address, model number, serial number, pressure rating and flow capacity.

3.13 FIELD STARTUP SERVICES

- A. General. Contractor shall provide complete field startup services for the Facility and its components and systems. Contractor shall provide appropriate field-startup services from manufacturers and vendors, including on-site assistance from the main vendor.
- B. Scope. Contractor shall initialize and make fully operational the following:
- C. Electrical service.
- D. Submerged-turbine pumps and pump controllers.
- E. Dispensers.
- F. Fuel management terminals.
- G. Emergency-shutdown system.

3.14 THIRD-PARTY TESTING

- A. Functional Testing.
- B. Measure dispenser flow rate through each nozzle by recording the time needed to dispense a known volume of product.
- C. Verify that all nozzles automatically shut-off properly at the completion of a fill.
- D. Verify that the fuel management system prevents fueling by unauthorized personnel, and that fill transactions are properly recorded and uploaded.
- E. Performance Testing. Performance test shall consist of fueling under normal use conditions for the Facility over five consecutive days. The system shall have no failures of fuel management, pumps, dispensers, or nozzles during the test period. If any failure occurs, the test shall be repeated in its entirety. Final acceptance of the Work may only be declared upon successful completion of the test.
- F. Failure is defined as the occurrence of any of the following:
- G. Inability of the system to dispense fuel product at a minimum of 25 GPM through each hose.
- H. Occurrence of any significant pump motor, pump controller, dispenser or fuel management system malfunctions.

- I. A failure will not be counted if the fueling system is unable to perform according to the specifications for a reason not related to defects in material and workmanship of the system or its components and if the cause is outside of the control of the contractor and his suppliers.
- J. Contractor may take equipment offline for scheduled maintenance during the test period, provided maintenance is consistent with manufacturer™s recommendations. Contractor shall be responsible for maintenance through successful completion of test, including provision of consumables.

3.15 OPERATION AND MAINTENANCE MANUALS

- A. Organize maintenance and operating literature into suitable sets of manageable size, and bind into individual binders, properly identified and indexed (thumb-tabbed). Examples: Pumps, pump controllers, piping, fuel dispensers, nozzles, etc. Include emergency instructions, safety procedures, spare parts listings, warranties, wiring diagrams, recommended maintenance intervals, inspection procedures, shop drawings, product data, and similar applicable information. Where data sheets contain multiple product listings or options, the model # and features meeting the project requirements shall be clearly marked.
- B. Content. Manual shall include all "Dispensing System equipment specified herein, and should also include aggregate maintenance-manual information for other fueling systems specified for fuel-storage tanks and for fuel-leak monitoring/detection.
- C. Media.
- D. Printed Version. Use a standard method for highlighting safety procedures. Bind each manual of each set in a heavy-duty 2-inch, three ring vinyl-covered binder and include pocket folders for folded sheet information. Mark identification on both the front and spine of each binder, including "Volume ## of ##" information. Provide (4) complete printed manuals for approval with the commencement of the delivery of the equipment to the site.
- E. Electronic Version. Provide PDF-based version of manual that matches content and organization of printed version. PDF content shall be indexed and text-searchable. Provide (4) complete PDF manuals on USB flash drive with indicating facility name, issue date, and "Petroleum Equipment Manual™".

END OF SECTION 23 12 17

SECTION 23 13 23 - ABOVE-GROUND FUEL STORAGE TANK SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. (1) aboveground diesel storage system including one new 12,000-gallon protected tank.
2. Aboveground tank appurtenances, including tank anchors with seismic restrains, fixed ladder and catwalk, tanker offloading station, and associated piping, equipment and accessories. Note that the aboveground tank vault may also be referred to as "aboveground storage tank" or AST.

B. Related Sections:

1. Section 23 12 17 æDiesel Fuel Dispensing System .
2. Section 28 34 01 æPetroleum Leak-Monitoring System .
3. Other project documents as required per contract.

1.02 REFERENCES

A. General. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

1. ASME International (ASME):

- a. ASME/ANSI B16.5 - 2009 - Pipe Flanges and Flanged Fittings
- b. ASME/ANSI B16.9 - 2007 - Factory-Made Wrought Butt welding Fittings
- c. ASME/ANSI B16.11 - 2009 - Forged Steel Fittings, Socket-Welding and Threaded.
- d. ASME/ANSI B16.34 - 2009 - Valves - Flanged, Threaded, and Welding End
- e. ASME/ANSI B36.19M - 2004 Stainless Steel Pipe

2. ASTM International (ASTM):

- a. ASTM A 36/A 36M (2004) Carbon Structural Steel.
- b. A53/A53M-04a Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- c. A106/A106M-04b Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
- d. ASTM A312 / A312M - 08 Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

3. Manufacturers Standardization Society Of The Valve and Fittings Industry (MSS):

- a. MSS SP-58 (2002) Pipe Hangers and Supports - Materials, Design and Manufacture.
 - b. MSS SP-69 (2002) Pipe Hangers and Supports -Selection and Application.
 - c. MSS SP-80 (2003) Bronze Gate, Globe, Angle and Check Valves.
- 4. National Fire Protection Association (NFPA):
 - a. NFPA 30 (2012) Flammable and Combustible Liquids Code.
 - b. NFPA 30A (2012) Code for Motor Fuel Dispensing Facilities and Repair Garages.
 - c. NFPA 70 - National Electrical Code (2011), with State of California and City of Taos Amendments.
- 5. Underwriters Laboratories (UL):
 - a. UL 142 (2002) Steel Aboveground Tanks for Flammable and Combustible Liquids.
 - b. UL 2085 (1997; Rev thru Dec 1999) Protected Aboveground Tanks for Flammable and Combustible Liquids.
 - c. UL 674 (2003) Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations.
 - d. UL 698 (1995; Rev through Mar 1999) Industrial Control Equipment for Hazardous (Classified) Locations.
 - e. UL 886 (1994; Rev thru Apr 1999) Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.
- 6. International Code Council:
 - a. International Fire Code (2011) with State of California and City of Santa Barbara amendments.

1.03 SYSTEM-DESCRIPTION SUMMARY

- A. Diesel AST. Provide one 12,000-gallon aboveground protected tank for storing diesel fuel. Tank shall be insulated and protected, listed under UL 142 and UL 2085, and equipped with (1) remote tanker offloading station as shown in the Drawings. Provide a cylindrical tank or rectangular tank that fits the structural tank pad shown on the drawings.
- B. Ancillary Components. Provide aboveground storage tank systems and associated fuel piping systems that are complete and operable, in accordance with these specifications and the drawings. Fuel piping systems covered in this section include, valves, tank penetrations for tanker offloading and level gauging.
- C. New Equipment. All equipment shall be newly manufactured and unused in any other installation or facility.

1.04 CONTRACTOR WORK EXPERIENCE

- A. General. The Contractor installing the fuel systems shall have constructed a minimum of five petroleum fueling facilities that include ASTs during the previous three years. Contractor shall provide documentation (work references) of his/her experience with the bid documents.

1.05 QUALITY ASSURANCE

- A. General. Materials, apparatus, and equipment required for the work described in this Section shall be constructed and installed in accordance with the references cited above; and with the requirements of the local and state building and plumbing codes and ordinances, all legally constituted public authorities having jurisdiction, including State and county laws, rules and regulations, and City of Taos ordinances.
- B. Pre-installation Conference. Conduct conference at Project site to comply with the project requirements.
- C. Permitting. Contractor shall obtain necessary operating permits in conjunction with installation of underground petroleum piping as may be required by federal, state, or local authority. Submit copy of permits to the Contracting Officer.

1.06 SUBMITTALS

- A. General. Contractor shall submit shop drawings and equipment data for review and approval by the Engineer, in writing, prior to ordering.
- B. Shop Drawings for AST. Submit shop drawings for the proposed pre-cast tank vault. Shop drawings shall indicate overall dimensions, primary and secondary containment tank materials and thicknesses, insulation material and thickness, and concrete mix, and reinforcement arrangement. Drawings shall also show the locations and sizes of all tank penetrations, including the emergency vent. Tank penetrations shall be located in accordance with the Drawings.
- C. Product Data. Manufacturer's Product data shall be submitted for the equipment listed below. Data shall include model numbers, materials of construction, features and design codes or standards used. Where data include several different products on one sheet, clearly mark the sheet to indicate which product(s) is (are) proposed. Furnish product data for the following items of equipment:
 - 1. Aboveground tank vault.
 - 2. Remote fill container.
 - 3. Overfill prevention valve and drop tube.
 - 4. Mechanical tank level gage.
 - 5. Ball valves.
 - 6. Check valve.

- D. Manufacturer Certifications. For the aboveground tank vault, Contractor shall provide information verifying that the vault manufacturer has a minimum of 10 years experience producing tank vaults per UL 2085. Certificates of compliance shall be submitted, including mill certificates for cement, aggregates, reinforcing steel, admixtures and embedded items, as applicable.

PART 2 - PRODUCTS

2.01 ABOVEGROUND DIESEL TANK

- A. General. Provide (1) 12,000-gallon protected tank vault for storing diesel fuel with cylindrical shape and overall dimension of 32TM-7 long x 8TM-7 diameter, or rectangular tank that fits the structural-tank pad as shown on the drawings. Tank vault shall be insulated with concrete, have secondary containment, and be integrally protected from vehicle impact and penetration by projectiles.
- B. Quality Assurance. Tank vault shall be manufactured according to the following:
1. National Fire Protection Association (NFPA 30) Flammable and Combustible Liquids Code.
 2. Factory Mutual System approval J.I. IG4AOAF.
 3. 30-year warranty against failure or breakage or collapse due to structural failure.
 4. 30-year warranty against failure from internal corrosion for use of gasoline, diesel fuel, or ethanol (up to 85 percent ethanol, 15 percent gasoline). Provide documentation from the tank manufacturer testifying that the tank is suitable for storing these petroleum products.
- C. Vault Design.
1. Tank vaults shall be constructed and listed in accordance with Underwriters Laboratories Inc. Standard 2085 for Insulated Secondary Containment Aboveground Tanks for Flammable and Combustible Liquids, Protected Type. The tank's fire rating shall exceed all requirements of The National Fire Protection Association Standards 30 and 30A for "fire resistant" tanks and meet the requirements of the California Fire Code for "protected" aboveground tanks.
 2. Tank vaults shall be resistant to bullet penetration according to the California Fire Code.
 3. All openings shall be from the top, with threaded NPT risers, or ANSI flanges, per the Drawings. All pipe risers shall be seamless ASTM A312 stainless steel pipe, using passivated Type 304L alloy.
 4. The tank manufacturer shall provide proof of a minimum 10 years of manufacturing vault tanks of the specified type.
 5. The primary steel tank shall be rectangular in shape and have continuous welds on all exterior seams, manufactured in accordance with UL listing requirements and UL Standard 142.
 6. The primary steel tank shall be pressure tested at 5 psig for a minimum duration of 48 hours.

7. The primary steel tanks shall have an 8 inch emergency vent system in accordance with the requirements of NFPA 30.
 8. The protected and insulated AST systems shall have a through-tank leak detector tube for continuous monitoring between the primary and secondary containment.
 9. The primary steel tank shall be pressurized at 5 psig during concrete encasement, if so encased.
 10. The primary tank shall be insulated against fire exposure by an external layer of concrete. The secondary tank may be constructed from either reinforced concrete, or steel. The AST must be shop fabricated and tested in accordance with the UL listings.
 11. The primary storage tank shall be constructed of ASTM A-569 or A-36 carbon steel.
 12. The primary tank shall be fitted with the following penetrations through the roof, and located as shown in the drawings:
 - a. (1) 4 inch Fill Ports.
 - b. (1) 4 inch normal vent port.
 - c. (1) 8 inch emergency vent port.
 - d. (1) 4 inch automatic liquid gauging port.
 - e. (1) 6 inch port suitable for a FE Petro or Red Jacket submerged pump.
 - f. (1) manway with minimum opening diameter of 24 inches and flanged opening with bolted cover.
 13. The primary tank shall be pressure tested to UL 142 Standard (minimum of 3 psig to maximum 5 psig) at the factory, and shall be field-tested by the contractor to a maximum of 3 psig.
 14. The primary steel tank shall be designed to store gasoline and diesel fuels.
- D. Exterior Accessories. All accessories shall be factory installed and engineered and include welding and painting as needed for a neat and uniform finish.
1. Vertical Ladder to access tank top / catwalk.
 2. Catwalk along full length of tank (applies only to round tanks).
 3. Welded-steel support shelf to support a fleet-type dispenser. Include anchoring bosses for steel dispenser-containment sump.
- E. Approved Products:
1. Hoover, manufactured by Containment Solutions Inc.
 2. Modern Welding ~Fire Guard™.
 3. Or approved equal.

2.02 REMOTE GROUND-LEVEL DIESEL FILL STATION

- A. General. Provide the diesel tank vault with a dedicated fill station attached to the tank, to contain spills from the tanker product fitting during product delivery.

- B. Specification. Fill station shall be fabricated from 12-gauge stainless steel, have a holding capacity of no less than 10 gallons, and be equipped with a hooded cover to prevent the entry of rainwater and dust. Station basin fitted with a drain line controlled by a ball valve. Fill station shall contain the remote fill adapter.
- C. Arrangement. Fill station shall be welded or bolted to the fill station at the factory and arranged so that the fill adapter is 3TM 6 to 4TM-0 AFF.
- D. Acceptable products.
 - 1. OPW 6211SS R-30 2 B3 LD with one 4 inch by 3 inch booted entry fitting.

2.03 REMOTE FILL ADAPTER

- A. General. Provide one 3 inch tanker fill adaptor for diesel. Adapter shall be equipped with a spring-loaded self-closing poppet valve to prevent product leakage after the fuel delivery coupler is disconnected. Poppet valve shall be equipped with a Viton seal.
- B. Acceptable product for diesel fill adaptor: OPW 1612AN-0300 Poppeted Kamvalok® Adaptor.

2.04 OVERFILL PREVENTION VALVE

- A. Furnish 3 inch overfill prevention valve above the drop tube. Valve shall be equipped with a float that closes the valve to prevent overfilling when than ullage decreases to 8 inches. Valve shall be designed for pumped offloading at pressures as high as 150 PSIG and flow rates as high as 400 GPM. Valve materials shall be designed for use with diesel and gasoline fuel.
- B. Acceptable products: OPW 61fSTOP-3050 Overfill Prevention Valve.

2.05 DROP TUBE

- A. General. Install a 3 inch extruded aluminum drop tube below the overfill prevention valve, to prevent product aeration during filling. Drop tube shall be designed for use with the overfill prevention valve selected.
- B. Measure and cut the drop tube with a 45 degree miter. The bottom end of the installed drop tube shall be 6 inches above the floor of the ASTTM's primary tank.
- C. Acceptable Products: OPW 61FT-0312 drop tube.

2.06 MECHANICAL TANK LEVEL GAUGE

- A. Furnish a mechanical level gage in tank vault, visible to personnel at the remote fill station. The gauge shall display product level in feet and inches, using a float inside a drop tube. The gauge and drop tube shall be listed and certified for gasoline and diesel.
- B. Acceptable product: OPW 200TG-ENG (gauge) and OPW 61T-0208 (drop tube), or approved equal.

2.07 ABOVEGROUND VENT AND PRODUCT PIPING

- A. Aboveground pipe normally wetted by petroleum fuel product shall be seamless carbon steel, ASTM A106 Grade B, Schedule 40 sized per drawings.
- B. Flanged fittings. Aboveground pipe NPS 3 and larger shall be joined by butt welding or by ANSI Class 150 Raised Face Weldneck Flanges, except as follows. Pipe thread connections may be used to connect to appurtenances, fittings and valves specified herein, and which utilize threaded couplings.
- C. Threaded Pipe Fittings. Threaded steel pipe shall be joined using ASME B16.11 Class 2000 Forged Steel Fittings, formed with Type 304L stainless steel.
- D. Threaded Joints: Threaded joints must be reamed and have clean-cut, perfect threads and be made up with non-hardening joint compound insoluble in petroleum products. Approved joint compounds include Rectorseal True Blue, Hercules Real Tuff, and Permatex High Temperature Thread Sealant.

2.08 PRESSURE-VACUUM VENT VALVE

- A. General. AST vent pipe shall be fitted with a atmospheric breather cap suitable for diesel. The valve shall include a 2" NPT connector, an anti-vector screen, and have its opening set minimum 12'™ above grade.
- B. Acceptable product:
 - 1. OPW 23 Series Open Atmospheric Vent
 - 2. Or approved equal

2.09 PROTECTIVE COATINGS (Paint)

- A. Aboveground tank vaults and tank appurtenances shall be delivered complete with their standard factory coating. These coatings shall be warranted by the tank manufacturer to not peel, spall or visibly deteriorate for not less than 15 years following application. Contractor shall obtain City's approval of proposed tank color before the tank is ordered.

- B. Aboveground carbon steel pipe shall be painted with a durable and diesel- and gasoline-resistant industrial maintenance coating. Finish coat shall be International Protective Coatings Interline 871, or approved equal.
 - 1. Clean and prepare pipe surface according to the paint manufacturer's written recommendations.
 - 2. Apply coating using a twin feed external spray unit. Clean all spray equipment with the paint manufacturer's recommended solvent, immediately after completing application.

PART 3 - EXECUTION

3.01 ABOVEGROUND TANK VAULTS

- A. Handle and transport pre-cast tank vaults with suitable equipment that will not damage or subject the product to excessive stresses.
- B. Additional reinforcing, inserts, strongbacks, or other items shall be provided at time of installation per pre-cast manufacturer's recommendations for erection and handling stresses.
- C. Install tank vaults as shown on the Drawings, and according to the tank manufacturer's recommendations. Anchor AST's to their foundations using the tank manufacturer's recommended seismic anchoring system. Refer to the Structural Drawings for details and design criteria.
- D. Contractor shall follow the vault manufacturer's written field installation guide detailing all steps necessary to properly install complete structure and all appurtenances connected to the tank vault.
- E. A manufacturer's technical field representative shall be present at jobsite on the day the vaults are set.

3.02 PRODUCT AND VENT PIPING

- A. Materials: All pipeline, fittings, risers, wrapping materials, etc., shall be furnished and installed by the Contractor.

3.03 HANDLING OF PIPE AND FITTINGS

- A. Steel Pipe and Fittings: Protect against damage to the protective coating, pipe threads or wrapping, if present.
- B. Installation Requirements:

1. Interior surface of all pipe and fittings must be free from dirt, scale, metal, etc., before connecting.
2. Vent piping shall terminate at a height of not less than 12 feet above ground surface. Fit vent with a suitable vent assembly

3.04 CUTTING OF PIPE

- A. Steel Pipe: Cut with hand or power operated pipe cutter, as in normal fitting practice.
1. Steel Pipe ends shall be reamed and deburred.

3.05 FIELD TESTS

- A. Test Procedure: Prior to application of test pressure, remove or valve off piping components which may be damaged by the test and install a currently calibrated test gauge in the system. Maintain test pressure for time periods specified in article B, below. In the event of leakage, locate and repair the leak(s) and repeat test.
- B. Tanks.
1. Pre-installation Tank-Pressure Test. Tighten all tank fittings. Locate a pressure gage in the vent/monitor fitting. Locate a second pressure gage at a fitting in the manway and connect the air pressure hose to this same fitting. Pressurize the tank to between 4.0 and 5.0 PSIG, using air. Monitor the pressure gages for a minimum of 2 hours.
 2. Post-Installation Tank Pressure Test. Procedures for pre-installation pressure test shall be repeated. This test may be performed with or without piping and fittings attached.
- C. Piping Test. During pneumatic tank testing, allow pressure to communicate with offload piping. Soap test at joints to detect leaks.
- D. Responsibility. The Contractor is responsible for all labor, materials, and equipment to conduct pressure tests (air or hydrostatic) of all product piping.

3.06 LABELING

- A. Major Equipment. The manufacturer shall provide a stainless steel or brass nameplate on each major item of equipment. The nameplate shall be mechanically affixed and shall be embossed with the manufacturer's name, address, model number, serial number, pressure rating and flow capacity, as applicable.
- B. Compartment. Label outside face of compartment with "DIESEL™". Use sign labeling w/ tank at least 3• tall and listed for outdoor installation.

3.07 FIELD STARTUP SERVICES

- A. General. Contractor shall provide complete field startup services for the Facility and its components and systems. Contractor shall provide appropriate field-startup services from manufacturers and vendors, including on-site assistance from the main vendor.
- B. Initial Fuel-Product Delivery.
 - 1. To facilitate startup tests, contractor shall co-ordinate with the Owner for the Owner to purchase and deliver at least 6,000 gallons of diesel product to each new AST/compartments, or as otherwise coordinated with the Owner. The Owner will purchase and provide the fuel.
 - 2. Care shall be taken with verifying exact order and delivery amounts provided, for purpose of reconciling with the monitoring console prior to consumption of any fuel.
- C. Requirements. Contractor shall initialize and make fully operational the following:
 - 1. Mechanical tank level gages.
 - 2. Fill and Phase I adapters and associated valves.
- D. Functional Tests.
 - 1. Observe offloading operation during the initial product delivery. Repair any valve malfunctions or piping leaks that occur during the delivery.
 - 2. Contractor shall document the amount of the initial product delivery in each tank against the automatic and mechanical tank-level readings for each tank, to ensure reconciliation.

3.08 OPERATION AND MAINTENANCE MANUALS

- A. Organize maintenance and operating literature into suitable sets of manageable size, and bind into individual binders, properly identified and indexed (thumb-tabbed). Examples: Pumps, pump controllers, piping, diesel dispensers, nozzles, etc. Include emergency instructions, safety procedures, spare parts listings, warranties, wiring diagrams, recommended maintenance intervals, inspection procedures, shop drawings, product data, and similar applicable information. Use a standard method for highlighting safety procedures. Bind each manual of each set in a heavy-duty 2-inch, three ring vinyl-covered binder and include pocket folders for folded sheet information. Mark identification on both the front and spine of each binder, including "Volume ## of ##" information.
 - 1. Delivery: Supply 4 complete manuals for approval with the commencement of the delivery of the equipment to the site.

END OF SECTION 23 13 23

SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This section includes general requirements for all Division 27 work and is supplemental and in addition to the requirements of Division 1.
- B. It is the intention of this Division of the Specifications and the Contract Drawings to describe and provide for the furnishing, installing, testing and placing in satisfactory and fully operational condition all equipment, materials, devices, and necessary appurtenances to provide a complete communication system. Provide all materials, appliances and apparatus not specifically mentioned herein or shown on the drawings, but which are necessary to make a complete, fully operational installation of all communications systems shown on the contract drawings or described herein. Connect equipment and devices furnished and installed under other Divisions of this specification (or the Owner) under this Division.
- C. Workmanship shall be of the best quality and competent and experienced technicians shall be employed and shall be under the supervision of a competent and experienced foreman.
- D. The drawings and specifications are complementary and what is called for or shown in either is required to be provided as if called for in both. Where conflicting information occurs within the drawings and specifications or between the drawings and specifications, the more expensive alternative shall be used as a basis for bidding and construction.
- E. See Division 01 for sequence of work.

1.03 WORK IN OTHER DIVISIONS

- A. See all other specifications for other work which includes but is not limited to:

Cutting and Patching

Door Hardware

Electronic Safety and Security

Equipment Wiring

Interior Lighting

Lightning Protection Systems

Lighting Control Systems

Architectural Ceiling Systems

Fire Stopping

Mechanical Control Wiring

Mechanical Equipment

Painting, Refinishing and Finishes

Temporary Power

1.04 SUSTAINABLE CONSTRUCTION

- A. Comply with Division 01 Sustainable Construction requirements.

1.05 CODES, PERMITS, INSPECTION FEES

- A. The following codes and standards are referenced in the Division 27 specifications. Perform all work and provide materials and equipment in accordance with the latest referenced codes and standards of the following organizations:

1. American National Standards Institute (ANSI)
2. National Electrical Manufacturer's Association (NEMA)
3. National Fire Protection Association (NFPA)
4. Underwriter's Laboratories (UL)
5. American Society for Testing and Materials (ASTM)
6. BICSI (A Telecommunications Association)
7. International Building Code (IBC)
8. Insulated Cable Engineers Association (ICEA)
9. Institute of Electrical and Electronic Engineers (IEEE)
10. Federal Communications Commission Rules and Regulations (FCC)
11. National Electrical Code (NFPA Article 70) (NEC)
12. National Electrical Safety Code (NESC)
13. Occupational Safety and Health Administration (OSHA)
14. Rural Utilities Service (RUS)
15. Telecommunications Industry Association (TIA)
16. Electronics Industry Alliance (EIA)
17. Uniform Building Code (UBC)
18. UL 2043 & UL 2239

19. NEMA VE1 & VE2

B. Install the communications systems based on the following:

NFPA 70 National Electrical Code as adopted and amended by the Local Jurisdiction.

IBC International Building Code as adopted and amended by the Local Jurisdiction.

C. Communications Specific:

1. ANSI/TIA-526-7-A: Measurement of Optical Power Loss of Installed Single-mode Fiber Cable Plant.
2. ANSI/TIA-526-14-C: Measurement of Optical Power Loss of Installed Multimode Fiber Cable Plant.
3. ANSI/TIA-568.0-D: Generic Telecommunications Cabling for Customer Premises.
4. ANSI/TIA-568.1-D: Commercial Building Telecommunications Infrastructure Standard
5. ANSI/TIA-568.2-D: Balanced Twisted Pair Telecommunications Cabling and Components Standards
6. ANSI/TIA-568.3-D: Optical Fiber Cabling Components Standard
7. ANSI/TIA-568.4-D: Broadband Coaxial Cabling and Components Standard.
8. ANSI/TIA-569-D: Telecommunications Pathways and Spaces
9. ANSI/TIA-606-C: Administration Standard for Telecommunications Infrastructure
10. ANSI/TIA-607-C: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
11. ANSI/TIA-758-B: Customer-owned Outside Plant Telecommunications Infrastructure Standard
12. ANSI/TIA-862-B: Structured Cabling Infrastructure Standard for Intelligent Building Systems
13. ANSI/TIA-942-B: Telecommunications Infrastructure Standard for Data Centers
14. ANSI/TIA-1179-A: Healthcare Facility Telecommunications Infrastructure Standard
15. ANSI/TIA-4966: Telecommunications Infrastructure Standard for Educational Facilities
16. TIA: Technical Service Bulletins (TSBs) (related to the above ANSI/TIA standards)
17. IEEE 802.11 Wireless Local Area Network Standard, including the IEEE 802.11a, 802.11b, 802.11g, and 802.11n Standards
18. BICSI: BICSI Customer Owned Outside Plant Design Manual, Latest Edition
19. BICSI: BICSI LAN and Internetworking Design Manual, Latest Edition
20. BICSI: BICSI Telecommunications Distribution Methods Manual, Latest Edition
21. BICSI: BICSI Telecommunications Cabling Installation Manual, Latest Edition
22. NEC: NFPA 70
23. FCC Part 68: Connection of Terminal Equipment to Telephone Network.

- D. The referenced codes and standards establish a minimum level of requirements. Where provision of the various codes conflict with each other, the more stringent provision shall govern. If any conflict occurs between referenced codes and this specification, the codes are to govern. Compliance with code requirements shall not be construed as relieving the Contractor from complying with any requirements of the drawings or specifications which may exceed the requirements of the governing codes and rules and not contrary to same.
- E. Obtain and pay for all licenses, permits and inspections required by laws, ordinances and rules governing work specified herein. Arrange for inspection of work by the inspectors and give the inspectors all necessary assistance in their work of inspection.

1.06 COORDINATION

- A. Coordinate work with that of the other Contractors and/or other trades doing work on the project. Examine all drawings and specifications of other trades for construction details and coordination. Make every reasonable effort to provide timely notice of work affecting other trades to prevent conflicts or interference as to space requirements, dimensions, openings, block-outs, sleeving or other matters which will cause delays or necessitate work-around methods.
- B. Obtain submittals and shop drawings of all equipment with communications connections furnished under other divisions of the specification and by the Owner. Provide all wiring in accordance with specific equipment requirements. Immediately advise the Architect of any changes which may affect the contract price.
- C. Special attention is called to the following items. Coordinate all conflicts prior to installation:
 - 1. Location of grilles, pipes, sprinkler heads, ducts, and other mechanical equipment so that all communications outlets and equipment are clear from and in proper relation to these items.
 - 2. Location of cabinets, counters, and doors so that communications outlets, and equipment are clear from and in proper relation to these items.
 - 3. Recessing and concealing communications materials in CMU walls, concrete construction, and precast construction.
 - 4. In every telecommunication room with either active or passive equipment the Contractor shall monitor the work of all trades to assure that the space and clearance requirements of code are met.
 - 5. Review specifications for other Divisions of the work to determine where other Divisions are requiring communication connections. Verify provisions shown on contract drawings by examining shop drawing submittals of other Divisions prior to submission to the Owner. Do not proceed with ordering of supporting equipment, until characteristics are verified. Proceed with rough-in only after verification of shop drawings.

- D. Digital format copies of bid drawings will be furnished to the successful bidder. Augment bid documents with additional information to ensure coordination between trades. Provide digital format communications systems drawings showing all ceiling devices, fixtures, raceways and cable tray locations and routing to mechanical contractor to be used for coordination drawings provided by mechanical contractor. Include dimensions and elevations of devices, fixtures, raceway, and cable tray.
- E. Furnish, install and place in satisfactory condition all raceways, boxes, conductors and connections and all other materials required for the communication systems shown or noted in the contract documents to be complete, fully operational and fully tested upon completion of the project. Raceways, boxes, and ground connections are shown diagrammatically only and indicate the general character and approximate location. Where routings of major raceways and telecommunication pathways are indicated on plan sheets, the routing information supplements the information on diagrams. If no routing information is shown, route the systems in a manner that will coordinate with new and existing infrastructure and the work of other trades.
- F. Consult the architectural drawings for the exact height and location of all communication equipment not specified herein or shown on the drawings. Make any minor changes (less than 6'-6" horizontal) in the location of the raceways, outlets, boxes, devices, wiring, etc., from those shown on the drawings without extra charge, where coordination requires or if so directed by the Architect before rough-in.
- G. Provide inserts or sleeves for outlet boxes, conductors, cables and/or raceways as required. Coordinate the installation thereof with other trades.
- H. The Contractor will not be paid for relocation of work, cuttings, patching, and finishing required for work requiring reinstallation due to lack of coordination prior to installation.

1.07 WARRANTY

- A. Refer to General Conditions of the Contract.

1.08 CORRECTION OF WORK

- A. Within one year after the date of Substantial Completion of the work, the Contractor shall correct any work found to be not in conformance with the Contract Documents promptly after written notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. This obligation shall survive acceptance of the work under this Contract and termination of the Contract. The Owner shall give such notice promptly after discovery of the condition.

1.09 SUBMITTALS AND SHOP DRAWINGS

- A. Submittals and Shop Drawings: Prepared under the direct supervision of a BICSI RCDD. Submit electronically in portable document format (PDF). Schedule so as not to delay construction schedule and no later than 60 days after award of contract Submit common brochure(s) with index and separated by specification section, containing all required catalog cuts. Allow two weeks for review for each submittal and resubmittal. Incomplete submittals and shop drawings which do not comply with these requirements will be returned for correction, revision, and resubmittal.
- B. Product Submittals:
1. Provide for all products specified under Division 27 specifications, except if otherwise noted. Product submittals are not required for consumable materials such as tape, Velcro, zip-ties, and fasteners, unless required as part of a structural anchorage and bracing submittal.
 2. Indicate listing by UL or other approved testing agency.
 3. Highlight electronically with yellow, blue, or red adequate information to demonstrate materials being submitted fully comply with contract documents.
 4. Review and check all material prior to submittal and stamp "Reviewed and Approved".
 5. Provide Manufacturer and/or lab certification that all product materials are PCB-free.
- C. Contractor Qualification Data: Provide most recent valid certification documentation for installation technician, installation supervisor, and field inspector and years of experience. These include BICSI ITS Installation Certifications and all relevant specific manufacturer product installation certifications.
- D. Shop drawings shall show:
1. Ratings of items and systems.
 2. How the components of an item or system are assembled, interconnected, function together and how they will be installed on the project.
 3. System layout floor plans with complete device layout, point-to-point wiring connection between all components of the system, wire sizes and color coding.
 4. Coordinate with other division shop drawings and submittals. Identify interface points and indicate method of connection.
 5. Communications Rooms: Submit 1/2" = 1'-0" detail plans and wall elevations of each room showing actual size of equipment in place. Identify coordinating elements such as structural beams or mechanical systems. Submittals shall show coordination among all suppliers of equipment, including power components, fire alarm, racks, nurse call, public address, security, etc. Submit room layouts at same time as material submittals, and prior to installation of any equipment.
- E. The Contractor agrees:
1. Submittals and shop drawings processed by the Architect are not change orders.

2. The purpose of submittals and shop drawings by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept.
 3. Submittals demonstrate equipment and material Contractor intends to furnish and install and indicate detailing fabrication and installation methods Contractor intends to use.
 4. To accept all responsibility for assuring that all materials furnished under this Division of the specifications meet, in full, all requirements of the contract documents.
 5. To pay for Engineers review cost of submittal review beyond one resubmittal.
- F. The Engineer's review is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Corrections or comments made during this review do not relieve contractor from compliance with the requirements of the drawings and specifications. Contractor is responsible for: Dimensions which shall be confirmed and correlated at the job site; fabrication process and techniques of construction; coordination of this work with that of all other trades; performing this work in a safe and satisfactory manner.
- 1.10 PROJECT CLOSE-OUT
- A. Coordinate with close-out provisions in Division 01 - General Requirements.
- 1.11 COMMUNICATIONS EQUIPMENT OPERATION AND MAINTENANCE (O&M) MANUALS
- A. Provide O&M manuals required in Division 01 - General Requirements including all equipment furnished under Division 27 - Communications of the specifications. Submit a preliminary copy in electronic format 60 days prior to completion of the project for checking and review. Deliver final bound corrected copies as noted in Division 01 - General Requirements 20 days prior to scheduled instruction periods. Obtain a receipt for the manuals and forward a copy of the receipt to the Engineer.
- B. The information included must be the exact equipment installed. Where sheets show the equipment installed and other equipment, the installed equipment shall be neatly and clearly identified on such sheets.
- C. These O&M manuals shall contain all the information needed to operate and maintain all systems and equipment provided in the project. Present and arrange information in a logical manner for efficient use by the Owner's operating personnel. The information provided shall include but not be limited to the following:
1. Equipment manufacturer, make, model number, size, nameplate data, etc.
 2. Description of system configuration and operation including component identification and interrelations. A master control schematic drawing(s) may be required for this purpose.
 3. Dimensional and performance data for specific unit provided as appropriate.
 4. Manufacturer's recommended operation instructions.

5. Complete parts list including reordering information, recommended spares and anticipated useful life (if appropriate). Parts lists shall give full ordering information assigned by the original parts manufacturer. Relabeled and/or renumbered parts information as reassigned by equipment supplier not acceptable.
 6. Shop drawings.
 7. Wiring diagrams.
 8. Signal equipment submittals shall contain step-by-step circuit description information designed to acquaint maintenance personnel with equipment operation in each mode of operation.
 9. A complete list of local (nearest) manufacturer representative and distributor contacts for each type of equipment and manufacturer. Include name, company, address, phone, fax, e-mail address, and web site.
 10. Cable test reports.
- D. Furnish complete wiring diagrams for each system for the specific system installed under the contract. "Typical" line diagrams will not be acceptable unless revised to indicate the exact field installation.
- E. Group the information contained in the manuals in an orderly arrangement by specification index. Provide index and divider sheets between categories with identifying tabs. Bind the completed manuals with hard board covers not exceeding 5" thick. (Provide two or more volumes if required.) Signal and communication systems shall be in separate volumes. Imprint the covers with the name of the job, Owner, Architect, Engineer, Contractor, and year of completion. Imprint the back edge with the name of the job, Owner, and year of completion.

1.12 INSTRUCTION PERIODS

- A. After substantial completion of the work and 20 days after the O&M manuals have been delivered to the Owner and after all tests and final inspection of the work by the Authority(s) Having Jurisdiction; demonstrate the systems and instruct the Owner's designated operating and maintenance personnel in the operation and maintenance of the various systems. The Contractor shall arrange scheduled instruction periods with the Owner. The Contractor's representatives shall be superintendents or foremen knowledgeable in each system and suppliers™ representatives when so specified. When more than one training session is specified, the second session shall be 30 to 90 days after the first as agreed to by the Owner.
- B. Include in each instruction session an overview of the system, presentation of information in maintenance manuals with appropriate references to drawings. Conduct tours of the building areas with explanations of maintenance requirements, access methods, servicing and maintenance procedures, equipment cleaning procedures and adjustment locations.
- C. Include the following scheduled instruction periods:
- | | | | |
|--------------------------|---------|------------|-----|
| | 1 | st Session | 2nd |
| 1. Communications System | 4 hours | 4 hours | |

1.13 AS-BUILT DRAWINGS

- A. Continually record the actual low voltage system(s) installation on a set of prints or PDFs kept readily available at the project during construction. These prints shall be used for this purpose alone.
 - 1. Mark prints electronically or with red erasable pencil. Mark the set to show the actual installation where the installation varies from the work as originally shown.
 - 2. Accurately locate with exact dimensions all underground and under-slab raceways and stub-outs.
 - 3. Note changes of directions and locations, by dimensions and elevations, as communications equipment, cabling, and infrastructure are actually installed.
 - 4. Include addenda items and revisions made during construction.
 - 5. Erase conditions not constructed or "X-out" and annotate "not constructed" to clearly convey the actual "as constructed" condition.
 - 6. Organize drawing sheets in manageable sets, bind and publish suitable titles, dates, and other identification on the cover sheet of each set.
- B. Transmit the as-built drawing set to the Architect at the completion of the work. Final payment to the contractor will not be authorized until these prints have been submitted to and accepted by the Architect.
- C. If required by Division 01 requirements or the project™s Digital Project Execution Plan (a.k.a. BIM-x Plan) provide as-built drawings or models in the relevant Autodesk, Inc. software format (e.g. BIM360, Revit, Auto-CAD). Confirm requirements with the Architect prior to beginning work.

1.14 FINAL ACCEPTANCE REQUEST

- A. Comply with the requirements of Division 01.

1.15 ABBREVIATIONS AND DEFINITIONS

- A. When the following abbreviations and definitions are used in relation to the work for Division 27 they shall have the following meanings:

Item Meaning

AHJ Authority Having Jurisdiction.

BICSI Building Industry Consulting Service International

BIM Building Information Modeling

Boxes Outlet, Junction or Pull Boxes.

Code All applicable codes currently enforced at project location.

Compression Compressed using a leverage powered (hydraulic or equivalent) crimping tool.

Connection All materials and labor required for equipment to be fully operational.

Exterior Location Outside of or penetrating the outer surfaces of the building weather protective membrane.

Fully Operational Tested, approved, and operating to the satisfaction of the AHJ, manufacturer and contract documents.

Install To enter or attach permanently into the project and make fully operational.

1. Mfr. Manufacturer.

NEC National Electrical Code, National Fire Protection Association, Publication #70.

Noted Shown or specified in the Contract Documents.

Provide Furnish and install.

Required As required by code, AHJ, contract documents, or manufacturer for the particular installation to be fully operational.

Shown As indicated on the drawings or details.

Wiring Raceway, conductors, and connections.

Accepted/Acceptable Work or materials conforming with the intent of the project, and in general, conforming to the pertinent information in the Construction Documents.

Approved/Approval The written approval of the Engineer.

Accessible/Easy access Access attained without requiring extensive removal of other materials to gain access.

Accessible Ceiling Acoustical tile hanging ceilings (æHard-lid ceilings, concealed spine, or sheetrock/gypsum ceilings, even when provided with access panels, are not considered an Accessible Ceiling.)

Agreement The contractual agreement between the Owner and the Contractor.

Communications

Infrastructure System: A communications Cabling System combined with a Communications Raceway System.

Concealed Hidden from sight in interstitial building spaces, chases, furred spaces, shafts, crawl spaces, etc.

Construction

Documents Collective term for the entire set of bound or unbound material describing the construction and services required, including all Drawings, Specifications, addenda issued prior to execution of the contract, and modifications issued after Execution of the Contract (such as change orders, construction change directives, supplemental instructions, etc.).

The Contractor The party responsible for providing the system(s) as indicated herein.

Drawings The graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including (but not limited to) plans, elevations, sections, details, schedules and/or diagrams.

Engineer/Consultant The party responsible for producing the communications system(s) Construction Documents.

Exposed Not concealed (see above) and not installed underground.

Final Completion The date when the Engineer confirms in writing that the Contractor has completed the work in accordance with the Construction Documents, including completion of all punch list items, cleanup work and delivery of all required guarantees, warranties, licenses, releases and other required deliverables.

Furnish To purchase, supply, and deliver to the project materials in new and operable condition, ready for installation.

Governing

Requirements Collective term for regulations, laws, ordinances, codes, rules, standards, requirements, and guidelines that govern the installation and inspection of the work defined in the Contract Documents.

Governing Authorities Entities or their representatives charged with formation and/or enforcement of Governing Requirements, such as the Authority Having Jurisdiction (AHJ).

Install To place in final position in fully operable, tested condition.

Inside Plant (ISP) Infrastructure within a building; includes raceways, cabling, termination components and racks/cabinets.

Or Equal, Or Equivalent Materials approved for use by the Engineer and which are dimensionally suitable and operationally identical to the specified item.

Outside Plant (OSP) Infrastructure exterior to a building.

Owner The Owner and the Owner's designated representative(s).

The Project The total construction of which the Work performed under the Contract Documents may be the whole or a part, and which may include construction by the Owner and/or separate contractors.

RCDD Registered Communications Distribution Designer (a BICSI credential)

Substantial Completion The date when all work required by the Construction Documents shall be

complete (subject to the final punch list to be prepared by the Engineer) and on which the applicable jurisdictional authorities have issued a temporary certification of occupancy.

Section An individual section of the Specifications.

Shown on Drawings Noted, indicated, scheduled, detailed, or any other written reference made on the Drawings.

Specifications The portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards and workmanship for the Work and performance of related services.

Specification Section(s) One or more sections of the Specifications.

Structured Cabling

System (SCS) Alternative term for Communications Cabling System

The Work The construction and services required by the Contract Documents, whether completed or partially completed, and all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the ContractorTMs obligations. The Work may constitute the whole or a part of the Project.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All materials and equipment installed shall have been tested and listed by Underwriters Laboratories or other approved testing organization and shall be so labeled unless otherwise permitted by the Authority Having Jurisdiction (Inspector).
- B. All materials to be new, free from defects and not less than quality herein specified. Materials shall be designated to ensure satisfactory operation and operational life in the environmental conditions which will prevail where they are being installed.
- C. Each type of materials furnished shall be of the same make, be standard products of manufacturers regularly engaged in production of such materials and be the manufacturer's latest standard design.
- D. All materials, equipment and systems furnished that include provisions for storing, displaying, reporting, interfacing, inputting, or functioning using date specific information shall perform properly in all respects regardless of the century. Any interface to other new or existing materials, equipment or systems shall function properly and shall be century compliant, both for information sent and received.
- E. All materials shall be PCB-free.
- F. All paint to be low-VOC.

2.02 SUBSTITUTION OF MATERIALS

- A. No Substitute: Where a specified product is indicated "no substitute", it is the intent of this specification to require new materials to be compatible with the existing installation or as specifically requested by the owner. To this end certain materials and systems no substitution will be allowed.
- B. Prior to Bid Opening: Acceptance of products other than those specified will be issued by addendum to the bid documents only after the following requirements are met and the proposed listed material is determined to meet or exceed the requirements:
 - 1. Requests for listing to be original material, clearly indicating the product fully complies with contract documents and be marked to clearly define and describe the product for which listing is requested.
 - 2. Samples shall be submitted if requested.
 - 3. Requests shall be received 10 days prior to bid opening.
 - 4. Requests containing insufficient information to confirm compliance with contract documents will not be considered.
- C. After Award of Contract: Substitution of products will be considered after award of contract only under the following conditions:
 - 1. The Contractor shall have placed orders for specified materials promptly after contract is awarded and the specified products cannot be delivered to the project to meet the Owner's construction schedule.
 - 2. The reason for the unavailability is beyond the Contractor's control, i.e., due to strikes, bankruptcy, discontinuance of manufacturer, acts of God.
 - 3. The specified product is no longer manufactured.
 - 4. There is compelling economic advantage to the Owner.
 - 5. There is compelling sustainable or environmental advantage.
- D. In all cases, should a substituted material result in requiring system or building modifications; the Contractor alone shall pay all costs to provide these modifications including all costs to the Engineer and Architect for redesign, and updating of record drawings required to accommodate the required modifications.

PART 3 - EXECUTION

3.01 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft. Handle all equipment carefully to prevent damage, breakage, denting, and scoring of finishes. Do not install damaged equipment.

- B. Store products subject to damage by the elements above ground, undercover in a weather tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instruction.

3.02 CUTTING BUILDING CONSTRUCTION

- A. Obtain permission from the Architect and coordinate with other trades prior to cutting. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. Cut concrete with diamond core drills or concrete saws except where space limitations prevent the use of such tools.
- B. All construction materials damaged or cut into during the installation of this work must be repaired or replaced with materials of like kind and quality as original materials by skilled labor experienced in that building trade.

3.03 FIRESTOPPING

- A. Apply firestopping to communications penetrations of fire rated floor and wall assemblies to maintain fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 section "Firestopping".

3.04 PAINTING

- A. Items furnished under this Division that are scratched or marred in shipment or installation shall be refinished with touchup paint selected to match installed equipment finish.

3.05 EQUIPMENT CONNECTION

- A. For equipment furnished under this or other Divisions of the specifications, or by owner, provide complete all connections necessary to serve such equipment and provide required control connections to all equipment so that the equipment is fully operational upon completion of the project.
- B. Investigate existing equipment to be relocated and provide new connections as required.
- C. Obtain rough-in requirements for equipment furnished under other divisions of this specification prior to roughing-in. Review shop drawings and submittals of other Divisions to determine requirements.

3.06 CLEAN UP

- A. Contractor shall continually remove debris, cuttings, crates, cartons, etc., created by this work. Such clean up shall be done daily and at sufficient frequency to eliminate hazard to the public, other workers, the building, or the Owner's employees. Before acceptance of the installation, Contractor shall carefully clean cabinets, panels, wiring devices, cover plates, etc., to remove dirt, cuttings, paint, plaster, mortar, concrete, etc. Blemishes to finished surfaces of apparatus shall be removed and new finish equal to the original applied.
 - 1. Wipe surfaces of communications tag equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - 2. Equipment installed prior to final clean-up shall be cleaned by the contractor. Jacks and patch panels that have construction dirt and dust shall be cleaned to like new condition.
- B. Materials recycling and salvage:
 - 1. Recycle all scrap metal.
 - 2. Salvage operable equipment removed from site and deliver to local resale organization.

3.07 TESTING AND DEMONSTRATION

- A. Demonstrate that all equipment operates as specified and in accordance with manufacturer's instructions. Perform tests in the presence of the Architect, Owner or Engineer. Provide all instruments, manufacturer's operating instructions and personnel required to conduct the tests. Repair or replace any equipment that fails to operate as specified and or in accordance with manufacturer's requirements.

3.08 END OF SECTION 27 05 00

SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 Specification Sections, and Section 27 05 00 "Common Work Results for Communications apply to this Section.
- B. In addition to the requirements of this specification, comply with the requirements of ANSI/TIA-607-D

1.02 SUMMARY

- A. Section Includes:
 - 1. Grounding conductors.
 - 2. Grounding connectors.
 - 3. Grounding busbars.
 - 4. Grounding labeling.

1.03 ABBREVIATIONS

- A. BCT: Bonding conductor for telecommunications.
- B. TBB: Telecommunications Bonding Backbone
- C. GE: Grounding Equalizer
- D. EMT: Electrical metallic tubing.
- E. PBB: Primary bonding busbar / Telecommunications main grounding busbar.
- F. SBB: Secondary bonding busbar / Telecommunications grounding busbar.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, details, and attachments to other work.

1.05 INFORMATIONAL SUBMITTALS

- A. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following:
 - 1. BCT, TBB, PBB, SBBs, and routing of their bonding conductors.
 - 2. Result of the ground resistance test measured at the point of BCT connection.
 - 3. Result of the bonding resistance test at each PBB and SBB and its nearest grounding electrode.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Comply with 270500 "Common Work Results for Communications"

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Installer must have personnel certified by BICSI on staff including an RCDD in charge of quality assurance and oversight of the work.

PART 2 - PRODUCTS

2.01 SYSTEM COMPONENTS

- A. Comply with ANSI/TIA-607-D.

2.02 CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Harger Lightning and Grounding.
 - 2. Panduit Corp.
 - 3. Tyco Electronics Corp.
 - 4. Or Equal
- B. Comply with UL 486A-486B.
- C. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.
 - 1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
 - 2. Cable Tray Equipment Grounding Wire: No. 6 AWG.

D. Cable Tray Grounding Jumper:

1. Not smaller than No. 6 AWG and not longer than 12 inches. If jumper is a wire, it shall have a crimped grounding lug with two holes and long barrel for two crimps. If jumper is a flexible braid, it shall have a one-hole ferrule. Attach with grounding screw or connector provided by cable tray manufacturer.

E. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Conductor: stranded conductor, sized per the Conductor Sizing Table below.
5. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

F. Conductor Sizing Table:

2.03 CONNECTORS

- A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Burndy; Part of Hubbell Electrical Systems.
 2. Chatsworth Products, Inc.
 3. Harger Lightning and Grounding.
 4. Panduit Corp.
 5. Tyco Electronics Corp.
 6. Or Equal
- C. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.
1. Electroplated tinned copper, C and H shaped.
- D. Signal Reference Grid Connectors: Combination of compression wire connectors, access floor grounding clamps, bronze U-bolt grounding clamps, and copper split-bolt connectors, designed for the purpose.
- E. Busbar Connectors: Cast silicon bronze, solderless compression or exothermic-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch centers for a two-bolt connection to the busbar.

- F. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.04 GROUNDING BUSBARS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Chatsworth Products, Inc.
 - 2. Harger Lightning and Grounding.
 - 3. Panduit Corp.
 - 4. Or Equal.
- B. PBB: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, 1/4 inch by 4 inches. The busbar shall be NRTL listed for use as PBB and shall comply with ANSI/TIA-607-D.
 - 1. Predrilling shall be with holes for use with lugs specified in this Section.
 - 2. Mounting Hardware: Stand-off brackets that provide a 4-inch
 - 3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.
- C. SBB: Predrilled rectangular bars of hard-drawn solid copper, 1/4 inch by 2 inches by 12 inches. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with ANSI/TIA-607-D.
 - 1. Predrilling shall be with holes for use with lugs specified in this Section.
 - 2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch
 - 3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.
- D. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with ANSI/TIA-607-D. Predrilling shall be with holes for use with lugs specified in this Section.
 - 1. Cabinet-Mounted Busbar: Terminal block, with stainless-steel or copper-plated hardware for attachment to the cabinet.
 - 2. Rack-Mounted Horizontal Busbar: Designed for mounting in 19 inch equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
 - 3. Rack-Mounted Vertical Busbar: 72 inches long with stainless-steel or copper-plated hardware for attachment to the rack.

2.05 LABELING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brother International Corporation.
 2. HellermannTyton.
 3. Panduit Corp.
 4. SYSTIMAX, A Commscope Company
 5. Or Equal.
- B. Comply with TIA-606-C and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine the AC grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.
- B. Inspect the test results of the AC grounding system measured at the point of BCT connection.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with connection of the BCT only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Bonding shall include the AC utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.
- B. Comply with NECA 1.
- C. Comply with ANSI/TIA-607-D.

3.03 APPLICATION

- A. Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Conductor Support:

1. Secure grounding and bonding conductors at intervals of not less than 36 inches

C. Grounding and Bonding Conductors:

1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
2. Install without splices.
3. Support at not more than 36-inch intervals.
4. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing that complies with requirements in Section 270528 "Pathways for Communications Systems," and bond both ends of the conduit to a SBB.

3.04 GROUNDING CONDUCTOR SIZING

- A. The BCT between the PBB and the AC service equipment ground shall be sized according to the distance between the two devices and according to the Conductor Sizing Table shown above in 2.2.F.
- B. The TBB and GE between SBB and SBB or SBB and PBB shall be sized according to the distance between the two devices and according to the Conductor Sizing Table shown above in 2.2.F.
- C. Equipment grounding conductors between communications equipment and the SBB shall be 6 AWG minimum.
- D. Equipment grounding conductors between equipment and the rack or cabinet busbar shall be 10AWG minimum.

3.05 GROUNDING BUSBARS

- A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally 72 inches above finished floor unless otherwise indicated.

3.06 CONNECTIONS

- A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.
- B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
- C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:

1. Use crimping tool and the die specific to the connector.
 2. Pretwist the conductor.
 3. Apply an antioxidant compound to all bolted and compression connections.
- D. Primary Protector: Bond to the PBB with insulated bonding conductor.
- E. Interconnections: Interconnect all SBBs with the PBB with the telecommunications backbone conductor. If more than one PBB is installed, interconnect PBBs using the grounding equalizer conductor. The telecommunications backbone conductor and grounding equalizer conductor shall be sized according to the distance between the two devices and according to the Conductor Sizing Table shown above in 2.2.F.
- F. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Install rack grounding busbar unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the SBB No. 6 AWG bonding conductors.
- G. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each SBB and PBB to the vertical steel of the building frame.
- H. Electrical Power Panelboards: Where an electrical panelboard for telecommunications equipment is located in the same room or space, bond each SBB to the ground bar of the panelboard.
- I. Shielded Cable: Bond the shield of shielded cable to the SBB in communications rooms and spaces. Comply with TIA/EIA-568-C when grounding screened, balanced, twisted-pair cables.
- J. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.
- K. Access Floors: Bond all metal parts of access floors to the SBB.
- L. Equipment Room Signal Reference Grid: Provide a low-impedance path between telecommunications cabinets, equipment racks, and the reference grid, using bonding conductors.
1. Install the conductors in grid pattern on 4-foot centers, allowing bonding of one pedestal from each access floor tile.
 2. Bond the SBB of the equipment room to the reference grid at two or more locations.
 3. Bond all conduits and piping entering the equipment room to the SBB at the perimeter of the room.
- M. Towers and Antennas:

1. Ground Ring: Buried at least 30 inches below grade and at least 24 inches from the base of the tower or mounting.
2. Bond each tower base and metallic frame of a dish to the ground ring, buried at least 18 inches below grade.
3. Bond the ground ring and antenna grounds to the equipment room PBB or SBB, buried at least 30 inches below grade.
4. Bond metallic fences within 6 feet of towers and antennas to the ground ring, buried at least 18 inches below grade.
5. Special Requirements for Roof-Mounted Towers:
 - a. Roof Ring: Meet requirements for the ground ring except the conductors shall comply with requirements in Section 264113 "Lightning Protection for Structures."
 - b. Bond tower base footings steel, the SBB in the equipment room, and antenna support guys to the roof ring.
 - c. Connect roof ring to the perimeter conductors of the lightning protection system.
6. Waveguides and Coaxial Cable:
 - a. Bond cable shields at the point of entry into the building to the SBB and to the cable entrance plate, using No. 2 AWG bonding conductors.
 - b. Bond coaxial cable surge arrester to the ground or roof ring using bonding conductor size recommended by surge-arrester manufacturer.

3.07 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.
- B. Comply with IEEE C2 grounding requirements.
- C. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches extends above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.
- D. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect grounding conductors to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

3.08 IDENTIFICATION

- A. Labels shall be preprinted or computer-printed type.
 - 1. Label PBB(s) with "fs-PBB," where "fs" is the telecommunications space identifier for the space containing the PBB.
 - 2. Label SBB(s) with "fs-SBB," where "fs" is the telecommunications space identifier for the space containing the SBB.
 - 3. Label the BCT and each telecommunications backbone conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.09 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 2. Test the bonding connections of the system using an AC earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a PBB and a SBB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.
 - a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.
 - 3. Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.
 - a. With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the PBB and each SBB. Maximum acceptable AC current level is 1 A.
- B. Excessive Ground Resistance: If resistance to ground at the BCT exceeds 5 ohms, notify Architect promptly and include recommendations to reduce ground resistance.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 27 05 26

SECTION 27 05 28 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and Section 27 05 00 "Common Work Results for Communications apply to this Section.

1.02 SUMMARY

- A. Section describes interior communications pathways including:
 - 1. Metal conduits and fittings.
 - 2. Optical-fiber-cable pathways and fittings.
 - 3. Surface pathways.
 - 4. Boxes, enclosures, and cabinets.
 - 5. Wire-basket cable trays.
 - 6. Wide Base Cable Supports.
 - 7. Soft Sling Cable Supports.
 - 8. Wall Outlets.
 - 9. Floor Boxes and Poke Through Devices.
 - 10. Pathways for Fire-Rated Penetrations.
- B. Related Requirements:
 - 1. Section 270543 "Underground Ducts and Raceways for Communications Systems" for exterior ductbanks, manholes, and underground utility construction.

1.03 ABBREVIATIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.
- D. EMT: Electrical metallic tubing (conduit)
- E. PVC: Polyvinyl Chloride (conduit)
- F. RNC: Rigid non-metallic conduit
- G. HDPE: High-density polyethylene (conduit)

1.04 ACTION SUBMITTALS

- A. Product Data: For cable support devices and accessories, surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
- C. Shop Drawings: For projects where the low voltage systems cable pathways are not shown on the drawings, they are to be contractor designed per Part 3. The contractor shall prepare and submit proposed main pathway (20 cables or more) layout drawings for review and approval by the Owner's representative prior to installing supports. Shop drawings shall:
 - 1. Indicate pathways on plan view showing pathway coordination with mechanical components, lighting components, sprinkler head components, plumbing components, and electrical components.
 - 2. Include elevations and sections to indicate space allocations and coordination with work of other trades.
 - 3. Include details to describe the different support configurations, accessories, attaching means and cable groupings.

1.05 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of pathway groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Seismic Qualification Certificates: For pathway racks, enclosures, cabinets, equipment racks and their mounting provisions, including those for internal components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.
 - 4. Detailed description of conduit support devices and interconnections on which certification is based and their installation requirements.
- C. Source quality-control reports.

1.06 QUALITY ASSURANCE

- A. Hangers, supports and accessories shall be listed to Underwriter's Laboratories, Inc Standard 2239.
- B. Comply with seismic requirements as defined by the AHJ. Coordinate with the structural anchorage and bracing Engineer for anchorage and bracing methods and requirements.
- C. Pre-Installation Meetings: Contractor shall set up a pre-installation meeting to discuss communication and other low voltage cable support layout work and installation guidelines. Contractor shall organize meeting a minimum of 30 days prior to initiating hangers and support installation work. Attendees shall include general contractor, cable tray contractor, cable contractor(s), mechanical contractor, sprinkler contractor low voltage system vendors, Architect and Engineer. Purpose of meeting shall be to coordinate work between the parties to have a consistent layout for all communications and low voltage system cables, minimize interferences and to make cable system accessibility for future Owner modifications and maintenance high priority issue for all installers.

1.07 COORDINATION

- A. Coordinate as required in section 27 05 00.
- B. Examine drawings and existing conditions above ceilings and include additional supports in bid price to avoid ducts, pipes, conduits, etc. Installation in existing ceilings is very difficult. Include extra labor time involved in bid price.

PART 2 - PRODUCTS

2.01 METAL CONDUITS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 3. Electri-Flex Company.
 - 4. O-Z/Gedney; a brand of EGS Electrical Group.
 - 5. Southwire Company.
 - 6. Thomas & Betts Corporation.
 - 7. Or equal.
- B. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with ANSI/TIA-569-E.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. ARC: Comply with ANSI C80.5 and UL 6A.
- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 2. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
- H. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 OPTICAL FIBER CABLE PATHWAYS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Alpha Wire Company.
 2. Arnco Corporation.
 3. Endot Industries Inc.
 4. IPEX.
 5. Lamson & Sessions; Carlon Electrical Products.
 6. Maxcell Fabric Innerduct
 7. Or equal.
- B. Description: Comply with UL 2024; flexible-type pathway, approved for plenum or riser installation unless otherwise indicated.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with ANSI/TIA-569-E.

2.03 SURFACE PATHWAYS

- A. General Requirements for Surface Pathways:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with ANSI/TIA-569-E.
- B. Surface Metal Pathways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Mono-Systems, Inc.
 - b. Panduit Corp.
 - c. Wiremold / Legrand.
 - d. Or equal.
- C. Surface Nonmetallic Pathways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL-94 V-0 requirements for self-extinguishing characteristics.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell Incorporated; Wiring Device-Kellems Division.
 - b. Lamson & Sessions; Carlon Electrical Products.
 - c. Mono-Systems, Inc.
 - d. Panduit Corp.
 - e. Wiremold / Legrand.
 - f. Or equal.

2.04 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hoffman; a Pentair company.
 2. Hubbell Incorporated; Killark Division.
 3. Lamson & Sessions; Carlon Electrical Products.
 4. O-Z/Gedney; a brand of EGS Electrical Group.
 5. RACO; a Hubbell company.
 6. Thomas & Betts Corporation.
 7. Wiremold / Legrand.
 8. Or equal.
- B. General Requirements for Boxes, Enclosures, and Cabinets:
1. Comply with ANSI/TIA-569-E.
 2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

- C. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, Type FD, with gasketed cover.
- E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, with gasketed cover.
- H. Device Box Dimensions: 4-11/16 inches square by 2-1/8 inches deep.
- I. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- J. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 4 with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- K. Cabinets:
 - 1. NEMA 4 stainless steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.
 - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.05 WIRE BASKET CABLE TRAYS

- A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.
 - 1. Source Limitations: Obtain cable trays and components from single manufacturer.
- B. Sizes and Configurations: See the Cable Tray Drawings for specific requirements
- C. Structural Performance: See articles for individual cable tray types for specific values for the following parameters:

1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
2. Concentrated Load: A load applied at midpoint of span and centerline of tray.
3. Load and Safety Factors: Applicable to both side rails and rung capacities.

D. Manufacturers: [Remove manufacturers if you can]

1. Cablofil/Legrand.
2. Cooper B-Line, Inc.
3. Mono-Systems, Inc.
4. Chatsworth Products, Inc.
5. Snaketray.
6. Approved equivalent

E. Description:

1. Configuration: Wires are formed into a standard wire mesh pattern with intersecting wires welded together. Mesh sections must have at least one bottom longitudinal wire along entire length of section.
2. Materials: High-strength-steel longitudinal wires with no bends.
3. Sizes:
 - a. Straight sections shall be furnished in standard lengths.
 - b. Wire-Basket Width and Depth as indicated on drawings.
4. Connector Assemblies: Bolt welded to plate shaped to fit around adjoining tray wires and mating plate. Mechanically joins adjacent tray wires to splice sections together or to create horizontal fittings.
5. Connector Assembly Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.
6. Hardware and Fasteners: Shall be of the same manufacture as cable tray.

2.06 WIDE BASE CABLE SUPPORTS

- A. J-hooks - Galvanized loop with integrated cable retainers, complies with ANSI/TIA structured cabling system requirements, as indicated in section 27 05 00.
- B. Accessories: Provide applicable accessories to independently support J-hooks from structure. This includes extender bracket for mounting multiple J-hooks on a single support, fasteners and clamps for connecting to wall, beams, rods, dedicated support wires and C and Z Purlins as required for specific construction.
- C. Manufacturer.
 1. nVent CADDY Cat HP J-hook series
 2. Chatsworth RapidTrak™ series
 3. Or approved equivalent.

2.07 SOFT CABLE SLING SUPPORTS

- A. Adjustable sling cable supports suitable for plenums. 4 inch or 6 inch diameter loop for 4-pair UTP cables or inner duct.
- B. Accessories: Provide applicable accessories to independently support slings from structure. This includes fasteners and clamps for connecting to walls, beams, rods, ceiling tee bars, dedicated support wires and C and Z Purlins as required for specific construction.
- C. Material
 - 1. Construction: Polyethylene strands woven and laminated, reinforced seams, connected steel mounting and fastening hardware.
 - 2. Suitable for plenum location installation
- D. Manufacturer
 - 1. nVent CADDY Cat425 series
 - 2. Or approved equivalent

2.08 WALL OUTLETS

- A. Shall consist of a 4-11/16" square, 2-1/8" deep (minimum) box, with knockouts for 3/4", 1", and 1-1/4" conduits, as manufactured by Steel City, OZ/Gedney or equal.
- B. Provide single gang device ring.
- C. Provide a minimum 1• individual conduit from each outlet location to an accessible ceiling space. Provide non-metallic conduit bushing prior to cable installation.

2.09 FLOOR BOXES AND POKE THROUGH DEVICES

- A. Coordinate with Division 26 requirements.

2.10 PATHWAYS FOR FIRE RATED PENETRATIONS

- A. Floor or wall fire rated pathway for communications cables.
 - 1. Manufacturer: STI, Inc., part number EZ-Path Series 22.
 - 2. Manufacturer: STI, Inc., part number EZ-Path Series 33.
 - 3. Manufacturer: STI, Inc., part number EZ-Path Series 44+.
 - 4. Manufacturer: Hilti, part number CP 653 2• .
 - 5. Manufacturer: Hilti, part number CP 653 4• .

PART 3 - EXECUTION

3.01 PATHWAY APPLICATION

- A. Indoors: Apply pathway products as specified below unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: EMT.
 - 2. Exposed and Subject to Physical Damage: IMC. Pathway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums
 - 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 - 4. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical-fiber-cable pathway.
 - 5. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: Riser-type, optical-fiber-cable pathway.
 - 6. Boxes and Enclosures: NEMA 250 Type 1, except use NEMA 250 Type 4 in institutional and commercial kitchens and damp or wet locations.
- B. Minimum Pathway Size for Communications: 1-inch trade size.
- C. Pathway Fittings: Compatible with pathways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use a sealant recommended by the fitting manufacturer and apply in a thickness and number of coats recommended by manufacturer.
 - 3. EMT: Comply with NEMA FB 2.10.
- D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- E. Install surface pathways only where indicated on Drawings.
- F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.02 INSTALLATION

- A. Comply with NECA 1, NECA 101, and ANSI/TIA-569-E for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- C. Complete pathway installation before starting conductor installation.
- D. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- E. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- G. Support conduit within 12 inches of enclosures to which attached.
- H. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for pathways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- I. Threaded Conduit Joints, Exposed to Wet, Damp, or Corrosive Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- J. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- K. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- L. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- M. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- N. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

- O. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.
- P. Surface Pathways:
1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
 2. Install surface pathway with a minimum 2-inch radius control at bend points.
 3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- Q. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
1. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- R. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.
- S. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service pathway enters a building or structure.
 3. Where otherwise required by NFPA 70.
- T. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
- U. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements.
- V. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- W. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

- X. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- Z. Set metal floor boxes level and flush with finished floor surface.
- AA. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 INSTALLATION OF NON-CONTINUOUS CABLE SUPPORTS

- A. Support all cables not supported in conduits and cable tray with J-hooks or slings. Space J-hooks or slings at a maximum of 48-inches apart and at each change of direction of the cables. Maintain maximum sag of 12-inches between supports.
- B. Install supports to route cables parallel and perpendicular to building lines. Hang cable supports from all thread rods, dedicated #8 galvanized ceiling drop wire or wall brackets connected directly to structure. Do not support from the ceiling grid, ceiling wire system, conduit, or other trades work.
- C. Provide appropriately sized J-hooks as required by cable types and quantities.
- D. Provide multiple hooks at each hanger location as required by cable count and cable segregation requirements.
- E. Install cable bundles no closer than 5-inches in all directions from ballasted light fixtures.
- F. Where main pathways are indicated on the drawings, contractor shall follow indicated pathway as closely as possible according to field conditions. Pathway for smaller cable counts shall be laid out and documented on the as-built drawings by the contractor.
- G. Where specific main pathways are not indicated, the cable pathways for all communication systems shall be laid out by the contractor and coordinated with other disciplines and the systems designer.
- H. Do not tie wrap cables to the J-hooks. Provide cable retainers at each J-hook.
- I. Provide applicable accessories to independently support J-hooks from structure, including extender bracket for mounting multiple J hooks on a single support, fasteners and clamps for connecting to wall, beams, rods, dedicated support wires and C and Z Purlins as required for specific construction.
- J. At a minimum, brace multiple J-hook assemblies from structure with diagonal braces at each change of direction.

- K. Coordinate the allocation of ceiling space and the mounting elevations of various systems to allow maintenance and accessibility for future modifications. Cable supports shall be as close to the ceiling as possible while allowing ceiling tiles to be removed. Supports shall be located to avoid interference with maintenance access to other equipment.

3.04 PULL BOXES

- A. Pull boxes shall be sized per the following table:

PULL BOX SIZING (inches)

	Conduit	Width	Length	Depth	Width increase for
	Trade	Size			additional conduit
1.	4	16	3	2	
	1-1/4	6	20	3	3
	1-1/2	8	27	4	4
2.	8	36	4	5	
	2-1/2	10	42	5	6
3.	12	48	5	6	
	3-1/2	12	54	6	6
4.	15	60	8	8	

3.05 PULL CORDS

- A. Nylon type pull cords shall be included in all raceways over 10 feet long. Leave not less than 12 inches of slack at each end of the pull wire.

3.06 RACEWAY RISER SLEEVES

- A. Riser raceways to be installed through floors with tops 6 inches above each floor to give continuous cable riser capability. Provide Firestopping to meet requirements of Division 01.

3.07 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.08 PROTECTION

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

END OF SECTION 27 05 28

SECTION 27 05 43 - UNDERGROUND DUCTS AND UTILITY STRUCTURES FOR COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.
- B. Division 27 Specification sections included in the contract.
- C. Manufacturer™s guidelines for installation and testing.

1.02 SUMMARY

- A. Section Includes:
 - 1. The work required under this Section consists of providing all underground ducts, raceways, handholes, and maintenance holes (vaults) for communication systems for the project as indicated on Plans or in this Specification.
 - 2. This section includes both site underground conduit and duct banks exterior to the building proper as well as underground conduits under the building slab and within the building envelope.
- B. List below includes the most common products and applications for underground site distribution for communications.
 - 1. Direct-buried conduit, ducts, and duct accessories.
 - 2. Concrete-encased conduit, ducts, and duct accessories.
 - 3. Handholes and boxes.
 - 4. Communications Vaults.

1.03 DEFINITIONS

- A. The term œoutside plant means telecommunications infrastructure designed for installation exterior to buildings.
- B. The term œunderground means below the native or finished surface of the earth. For purposes of this section, œunder-slab means within the building envelope and under the finished floor surface and œsite designates structures or concrete outside the building and contained generally under dirt, paving, streets, or outside structures.

- C. The term æCommunications Vault refers to an underground structure large enough to allow human entry, used for the purpose of pulling communications cabling in the outside plant. In this specification the terms Maintenance hole, Manhole, Vault, and Communications Vault are used interchangeably.
- D. RNC: Rigid Nonmetallic Conduit
- E. RMC: Rigid Metallic Conduit
- F. HDPE: High Density Polyethylene

1.04 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include ducts and conduits and their accessories including bends, fittings, and solvent cement.
 - 2. Include conduit duct-bank materials, including separators and miscellaneous components.
 - 3. Include accessories for vaults, handholes, boxes, and other utility structures.
 - 4. Include warning tape.
 - 5. Product Certificates: For concrete and steel used in precast concrete vaults and handholes, as required by ASTM C858.
- B. Shop Drawings:
 - 1. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.
 - a. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
 - b. Drawings shall be signed and sealed by a qualified professional engineer.
 - 2. Precast or Factory-Fabricated Underground Utility Structures:
 - a. Include plans, elevations, sections, details, attachments to other work, and accessories.
 - b. Include duct entry provisions, including locations and duct sizes.
 - c. Include reinforcement details.
 - d. Include frame and cover design and vault frame support rings.
 - e. Include grounding details.
 - f. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
 - g. Include joint details.
 - 3. Factory-Fabricated Handholes and Vaults Other Than Precast Concrete:

- a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
- b. Include duct entry provisions, including locations and duct sizes.
- c. Include cover design.
- d. Include grounding details.
- e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.05 QUALITY ASSURANCE

- A. All work shall comply with the requirements and recommendations of the product manufacturers.

1.06 FIELD CONDITIONS

- A. Contractor is responsible for field verification of existing underground utilities in the area of work. Coordination and a mitigation plan for work near existing utilities shall be completed before new work is started.
- B. Interruption of Existing Communication Service: Do not interrupt communication service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Architect and Owner no fewer than 5 business days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Owner's written permission.

1.07 REGULATORY REQUIREMENTS

- A. All Work shall conform to the requirements of NFPA 70.
- B. All Work shall conform to the requirements of all Federal, State and Local Electrical and Telecommunications Regulations.

1.08 DESCRIPTION AND GENERAL SPECIFICATIONS

- A. Provide all labor, materials, tools, equipment and services required to complete the work described herein and shown on the drawings and as required to provide a fully operational system.
- B. Raceways and other materials and appurtenances shall be UL listed, approved and suitable for the environment where installed.

- C. The drawings, which constitute a part of these specifications, indicate the general route of the pathway systems. Contractor shall verify existing field conditions and coordinate exact routing, location, distance and levels and other work of this Section with other trades prior to installation.
- D. Notify the Designer or Owner™s Representative of any changes due to conflicts with other trades work, or due to any other reason other than of a minor nature prior to proceeding with work.
- E. Make necessary provisions for storage of materials and equipment at the site to ensure the quality and condition of the product to be installed. Use only materials and products that are new, free of defect, and which arrive unopened and in the original container at the jobsite.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR DUCTS AND UTILITY STRUCTURES

- A. All products must comply with ANSI C2.
- B. Duct Accessories:
 - 1. Pull String and Cords: Provide continuous conduit measuring tape in each duct.
 - 2. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and size of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during concreting or backfilling.
 - 3. Duct Sealant: System shall limit water infiltration while allowing for movement of the joint.
- C. Warning Tape
 - 1. Description: 6-inch-wide metallic warning tape, orange in color.
 - 2. Text: æCAUTION COMMUNICATIONS DUCT BANK BELOW
 - 3. Locator type: Locator wire integral to warning tape. No separate trace wire required.
 - 4. Manufacturer: Scotch Buried Barricade Tape 400 or approved equal.

2.02 METALLIC DUCT AND DUCT ACCESSORIES

- A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

2.03 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. Underground HDPE Plastic Utilities Duct: NEMA TC 2, UL 651, ASTM F 512, PVC sch 40 and PVC sch 80 as noted on drawings, with matching fittings complying with NEMA TC 3 by same manufacturer as the duct.

2.04 SUBDUCTING

- A. Innerducts
 1. Construction: Precision-extruded PVC resin
 2. Sizes: 3/4" to 2" diameter. Provide as indicated on plans or:
 - a. Provide (4) 1" innerducts in a single 4" conduit.
 3. Pull-tape: Provide with Kevlar pull tape for 1" and greater diameters.
 4. Fire-rating: Riser-rated
 5. Markings: Footages shall be sequentially marked.

2.05 PRECAST CONCRETE HANDHOLES AND BOXES

- A. Comply with ASTM C858 for design and manufacturing processes.
- B. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
 1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
 2. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
 3. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.
 - a. Cover Hinges: Concealed, with hold-open ratchet assembly.
 - b. Cover Handle: Recessed.
 4. Frame and Cover: Weatherproof aluminum frame with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing bolts.
 - a. Cover Hinges: Concealed, with hold-open ratchet assembly.
 - b. Cover Handle: Recessed.
 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 6. Cover Legend: Molded lettering, "COMMUNICATION."
 7. Configuration: Units shall be designed for flush unless otherwise indicated.

8. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
 - a. Extension shall provide increased depth to accommodate communications infrastructure and maintain flush mount installation.
 - b. Slab: Same dimensions as bottom of enclosure and arranged to provide closure.
9. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
10. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
 - a. Type and size shall match fittings to duct or conduit to be terminated.
 - b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.
11. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.06 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. General Requirements for Handholes and Boxes: Comply with ANSI/SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
 1. Color: Coordinate with Landscape Architect.
 2. Configuration: Units shall be designed for flush burial unless otherwise indicated.
 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 5. Cover Legend: Molded lettering, "COMMUNICATION."
 6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
 7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 8. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.
- B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
- C. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.

2.07 PRECAST COMMUNICATIONS VAULTS

- A. Comply with ASTM C 858.
- B. Structural Design Loading: Comply with requirements in "Underground Enclosure Application" Article.
- C. Precast Vaults: One-piece units and units with interlocking mating sections, complete with accessories, hardware, and features.
- D. Duct Entrances in Vault Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
 - 1. Type and size shall match fittings to duct or conduit to be terminated.
 - 2. Fittings shall align with elevations of approaching ducts and be located near interior corners of vaults to facilitate racking of cable.
- E. Concrete Knockout Panels: 1-1/2 to 2 inches thick, for future conduit entrance and sleeve for ground rod.
- F. Ground Rod Sleeve: Provide a 3-inch PVC conduit sleeve in vault floors 2 inches from the wall adjacent to, but not underneath, the ducts routed from the facility.
- G. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

2.08 CAST-IN-PLACE COMMUNICATIONS VAULTS

- A. Description: Underground utility structures, constructed in place, complete with accessories, hardware, and features. Include concrete knockout panels for conduit entrance and sleeve for ground rod.
- B. Materials: Comply with ASTM C858 and with Section 033000 "Cast-in-Place Concrete."
- C. Structural Design Loading: As specified in "Underground Enclosure Application" Article.

2.09 UTILITY STRUCTURE ACCESSORIES

- A. Vault Frames and Cover Components: Comply with structural design loading specified for vault.
 - 1. Cover Legend: Cast in. Text shall read œCOMMUNICATION and a unique identifier for the vault.

- B. Vault Sump Frame and Grate: ASTM A 48/A 48M, Class 30B, gray cast iron.
- C. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch-diameter eye, and 1-by-4-inch bolt.
 - 1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.
- D. Pulling Eyes in Nonconcrete Walls: Eyebolt with reinforced fastening, 1-1/4-inch-diameter eye.
- E. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch- diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.
 - 1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.
- F. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.
 - 1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.
- G. Ground Rod Sleeve: 3-inch, PVC conduit sleeve in vault floors 2 inches from the wall adjacent to, but not underneath, the ducts routed from the facility.
- H. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.
- I. Cable Rack Assembly: Steel, galvanized, except insulators.
 - 1. Stanchions: T-section or channel; 2-1/4-inch nominal size; punched with 14 holes on 1-1/2-inch centers for cable-arm attachment.
 - 2. Arms: 1-1/2 inches wide, lengths ranging from 3 inches with 450-lb minimum capacity to 18 inches with 250-lb minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.
 - 3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.
- J. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.
 - 1. Stanchions: Nominal 36 inches high by 4 inches wide, with minimum of nine holes for arm attachment.

- 2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches with 450-lb minimum capacity to 20 inches with 250-lb minimum capacity. Top of arm shall be nominally 4 inches wide, and arm shall have slots along full length for cable ties.
- K. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.
- L. Fixed Vault Ladders: Arranged for attachment to of vault.

2.10 SOURCE QUALITY CONTROL

- A. Test and inspect precast concrete utility structures according to ASTM C1037.
- B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of vaults and boxes for compliance with ANSI/SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by an independent testing agency.
 - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Coordinate layout and installation of ducts, vaults, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of ducts and duct-bank entrances into vaults, handholes, and boxes with final locations and profiles of ducts and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct runs drain to vaults and handholes, and as approved by Architect.

- C. In the event a conflict with an underground utility or other condition is discovered during the execution of the work of this Section, and such conflict prevents installation of the system as indicated, Contractor shall immediately notify the Designer or Owner™s Representative of such conflict for resolution prior to proceeding with work.
- D. Clear and grub vegetation to be removed and protect vegetation to remain according to Division 31 "Site Clearing." Remove and stockpile topsoil for reapplication according to Division 31 "Site Clearing."

3.02 EARTHWORK

- A. Excavation and Backfill: Comply with Division 31 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Cut and patch existing pavement in the path of underground ducts and utility structures according to the "Cutting and Patching" Article in Section 017300 "Execution."

3.03 DUCT INSTALLATION

- A. Ducts: RNC, NEMA PVC Type EPC-80 and Type EPC-40 as indicated on drawings, in concrete-encased duct bank unless otherwise indicated.
 - 1. Underground Conduit not in roadways or trafficways: RNC, Type EPC-40-PVC, concrete encased.
 - 2. Underground Conduit in roadways or trafficways: RNC, Type EPC-80-PVC, concrete encased.
- B. Install ducts according to NEMA TCB 2.
- C. Slope: Pitch ducts a minimum slope of 1:300 down toward vaults and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two vaults, to drain in both directions.
- D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 15 times the outside diameter of the conduit both horizontally and vertically, at other locations unless otherwise indicated.
- E. Underground Conduit Sweeps and Bends:

1. Conduits shall have no more than 180 degrees of cumulative bends between pull points. The 180-degree maximum shall include kicks and offsets. Where it is not possible to construct a section of conduit within the 180-degree sweep maximum, an intermediate maintenance or hand hole shall be installed.
 2. Except where noted below, all sweeps and bends shall be factory-manufactured bends with a minimum radius of 15 times the outside diameter of the conduit or as specified in Part II.
 3. Where parallel conduits are installed within a ductbank, the minimum sweep radius of each conduit shall be the same that of the largest conduit. For 90 degree bends, conduits shall be bent and placed in a concentric manner, with the inside conduit having a bend radius of at least 10 times the largest conduit.
 4. An individual bend or sweep shall not exceed 90 degrees.
 5. Two 90-degree sweeps separated by less than 20 feet is not permitted without written approval of the Designer or unless otherwise indicated on drawings.
 6. Where unique construction requirements for bend radius or arc length do not permit the use of factory-manufactured sweeps, sweeps may be field-manufactured using factory-recommended equipment upon written approval of the Designer. The internal diameter of the sweep shall not be changed during the sweep field-manufacturing process.
- F. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- G. Installation Adjacent to High-Temperature Steam Lines: Where duct banks are installed parallel to underground steam lines, perform calculations showing the duct bank will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct bank crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.
- H. Duct Entrances to Vaults and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
 2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to vault or handhole. Install an expansion fitting near the center of all straight line direct-buried duct banks with calculated expansion of more than 3/4 inch.
 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- I. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall, without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Section 270544 "Sleeves and Sleeve Seals for Communications."

- J. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- K. Pulling Cord: Install 100-lbf- test nylon cord in empty ducts.
- L. Concrete-Encased Ducts: Support ducts on duct separators.
 - 1. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 "Earth Moving" for pipes less than 6 inches in nominal diameter.
 - 2. Width: Excavate trench 12 inches wider than duct bank on each side.
 - 3. Width: Excavate trench 3 inches wider than duct bank on each side.
 - 4. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
 - 5. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
 - 6. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than four spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 - 7. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
 - 8. Separation from other utilities: Follow the requirements of the NESC and NEC but minimally separate facilities as follows:
 - a. Power up to one KVA:
 - 1) 12 in. of well- packed earth
 - 2) 4 in. of masonry
 - 3) 3 in. of Concrete
 - b. Gas, Oil, Water, etc.:
 - 1) 12 in. when parallel
 - 2) 6 in. when crossing
 - 9. Where underground crossings are known, field verify horizontal and vertical locations prior to excavation and placement of conduit. Any profile changes and existing utility line crossings are to be as built on drawings showing type of line, size, and depth below the surface.
 - 10. Conduit or duct banks shall maintain 1-foot vertical and 1-foot horizontal separation from other utility lines.

11. Underground Clearance: Where underground conduits run parallel with pipelines, a 1-foot minimum clearance shall be maintained, and at crossings, a 1-foot minimum clearance will be maintained below the bottom of the pipes. Conduits should cross under existing pipes when practical and reasonable.
12. Elbows: Use manufactured duct elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run unless otherwise indicated. Extend concrete encasement throughout length of elbow.
13. Elbows: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.
 - a. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3-inches of concrete.
 - b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60-inches from edge of base. Install insulated grounding bushings on terminations at equipment.
14. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
15. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
16. Concrete Cover: Install a minimum of 3-inches of concrete cover at top and bottom, and a minimum of 2-inches on each side of duct bank.
17. Concreting Sequence: Pour each run of envelope between vaults or other terminations in one continuous operation.
 - a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations or use other specific measures to prevent expansion-contraction damage.
 - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing-rod dowels extending a minimum of 18-inches into concrete on both sides of joint near corners of envelope.
18. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 033000 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

M. Direct-Buried Duct Banks:

1. Excavate trench bottom to provide firm and uniform support for duct bank. Comply with requirements in Section 312000 "Earth Moving" for preparation of trench bottoms for pipes less than 6-inches in nominal diameter.

2. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
 3. Space separators close enough to prevent sagging and deforming of ducts, with not less than four spacers per 20-feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6-inches between tiers.
 4. Depth: Install top of duct bank at least 36-inches below finished grade unless otherwise indicated.
 5. Set elevation of bottom of duct bank below frost line.
 6. Install ducts with a minimum of 3-inches between ducts for like services and - 6-inches between power and signal ducts.
 7. Elbows: Install manufactured duct elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
 8. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.
 - a. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3-inches of concrete.
 - b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60-inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
 9. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4-inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Division 31 "Earth Moving" for installation of backfill materials.
 - a. Place minimum 3-inches of sand as a bed for duct bank. Place sand to a minimum of 6-inches above top level of duct bank.
 - b. Place minimum 6-inches of engineered fill above concrete encasement of duct bank.
- N. Warning Planks: Bury warning planks approximately 12-inches above direct-buried ducts and duct banks, placing them 24-inches o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18-inches. Space additional planks 12-inches apart, horizontally.

- O. Warning Tape: Bury warning tape approximately 12-inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3-inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18-inches. Space additional tapes 12-inches apart, horizontally.

3.04 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Cast-in-Place Vault Installation:

1. Finish interior surfaces with a smooth-troweled finish.
2. Windows for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2-inches thick, arranged as indicated.
3. Comply with requirements in Division 03 "Cast-in-Place Concrete" for cast-in-place concrete, formwork, and reinforcement.

B. Precast Concrete Handhole and Vault Installation:

1. Comply with ASTM C891 unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevations:

1. Vault Roof: Install with rooftop at least 15-inches below finished grade.
2. Vault Frame: In paved areas and trafficways, set frames flush with finished grade. Set other vault frames 1-inch above finished grade.
3. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1-inch above finished grade.
4. Where indicated, cast handhole cover frame integrally with handhole structure.

D. Vault Access: Circular opening in vault roof; sized to match cover size.

1. Vaults with Fixed Ladders: Offset access opening from vault centerlines to align with ladder.
2. Install chimney, constructed of precast concrete collars and rings, to support cast-iron frame to connect cover with vault roof opening. Provide moisture-tight masonry joints and waterproof grouting for frame to chimney.

E. Waterproofing: Apply waterproofing to exterior surfaces of after concrete has cured at least three days. After ducts have been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars.

- F. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms as required for installation and support of cables and conductors and as indicated.
- G. Fixed Vault Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in vaults.
- H. Field-Installed Bolting Anchors in Vaults and Concrete Handholes: Do not drill deeper than 3-7/8 inches for vaults and 2-inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.
- I. Labeling: Affix a permanent tag or label to each duct or raceway inside vault identifying conduit number, far end location, and footage distance.

3.05 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1-inch above finished grade.
- D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
- E. Field cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- F. Labeling: Affix a permanent tag or label to each duct or raceway inside vault identifying conduit number, far end location, and footage distance.

3.06 GROUNDING

- A. Ground underground ducts and utility structures according to Section 270526 "Grounding and Bonding for Communication Systems."

3.07 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of vaults, including sump. Remove foreign material.

3.08 AS-BUILT DOCUMENTATION

- A. Contractor shall provide as-built and record document information to Owner as specified in Division 27 Common Work Results for Communication.
- B. Indicate location of all underground routes, if different than original drawing.

END OF SECTION 27 05 43

SECTION 27 11 00 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 27 05 00 - Common Work Results for Communications

1.02 SUMMARY

- A. Section Includes:
 - 1. Communications equipment and hardware mounting elements.
 - 2. Backboards.
 - 3. Communications equipment racks and cabinets.
 - 4. Grounding.

1.03 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. LAN: Local area network.
- C. RCDD: Registered Communications Distribution Designer.

1.04 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

C. Closeout Submittals " In accordance with section 27 05 00.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel credentialed by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.

PART 2 - PRODUCTS

2.01 BACKBOARDS

A. Backboards: Plywood, 3/4 by 48 by 96 inches. APA interior grade Douglas Fir A-C. Shall be fire retardant treated with flame spread rating not more than 25 when tested according to ASTM E84. Paint with light colored (white or off white) fire retardant paint. Comply with requirements for plywood backing panels specified in Section 061000 "Rough Carpentry."

1. Backboards are to start +12" AFF and extend to a height of +9' AFF.
2. Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.
3. Painted with two (2) coats of paint. Painted finish in the room will be light colored to enhance room lighting.
4. One (1) fire-retardant stamp is to be left unpainted on the bottom of each individual piece of fire-retardant plywood.

2.02 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ADC.
2. Belden Inc.
3. Chatsworth Products Inc.
4. Cooper B-Line.
5. Emerson Network Power Connectivity Solutions.
6. Hubbell Premise Wiring.

7. Leviton Commercial Networks Division.
8. Middle Atlantic Products, Inc.
9. Ortronics, Inc.
10. Panduit Corp.
11. Siemon Co. (The).
12. Tyco Electronics Corporation; AMP Products.
13. Or Approved Equal.

B. General Frame Requirements:

1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension: Width compatible with EIA 310-D standard, 19-inch panel mounting.
3. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Floor-Mounted Racks: Modular-type, aluminum construction.

1. Vertical and horizontal cable management channels, top and bottom cable troughs, and grounding lug.
2. Baked-polyester powder coat finish.

D. Modular Freestanding Cabinets:

1. Removable and lockable side panels.
2. Hinged and lockable front and rear doors.
3. Adjustable feet for leveling.
4. Screened ventilation openings in the roof and rear door.
5. Cable access provisions in the roof and base.
6. Grounding bus bar.
7. Power strip.
8. Baked-polyester powder coat finish.
9. All cabinets keyed alike.

E. Modular Wall Cabinets:

1. Wall mounting.
2. Treated to resist corrosion.
3. Lockable front and rear doors.
4. Louvered side panels.
5. Cable access provisions top and bottom.
6. Grounding lug.
7. 250-cfm fan.
8. Power strip.
9. All cabinets keyed alike.

F. Vertical Cable Management for Equipment Frames:

1. Vertical cable management panels shall have front and rear channels, with covers.

2. Size: Refer to the Drawings for sizes.

G. Horizontal Cable Management for Equipment Frames:

1. Provide horizontal wire managers with integral covers. Sizes and locations as indicated on drawings.

2.03 LADDER RACKING/CABLE RUNWAY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Chatsworth Products Inc.
2. Cooper B-Line.
3. Or Approved Equal.

B. Cable Runway Requirements: Rectangular steel tubing, 1-1/2" x 3/8" x 0.065". Cross members welded at 12" intervals.

C. Cable Runway Accessories: Provide cable runway with the following accessories:

1. Cable runway radius drop (œwaterfalls)
2. Butt-splice kit
3. Junction splice kit
4. Channel Rack-to-runway mounting plate
5. Triangular support bracket
6. Wall angle support kit
7. End caps
8. Vertical wall bracket kit

2.04 CABLE SPILLWAYS

A. Fits 4" diameter EMT conduits. Blue in color, made of fire-retardant ABS and stainless steel.

1. Manufacturer: Bejed, part number BJ-2049

2.05 GROUNDING

A. Comply with ANSI/TIA-607-D, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.

B. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

2.06 LABELING

- A. Comply with ANSI/TIA-606-C and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout and installation of communications rooms.
- C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- D. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
 - 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 - 2. Record agreements reached in meetings and distribute them to other participants.
 - 3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
 - 4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.
- E. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.02 FIRESTOPPING

- A. Comply with requirements in Division 07 "Penetration Firestopping."
- B. Comply with ANSI/TIA-569-E, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.03 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI/TIA-607-D.
- C. Comply with Section 27 05 26 æGrounding and Bonding for Communications Systems• .

3.04 IDENTIFICATION

- A. Identify equipment racks and cabinets, system components, wiring, and cabling complying with ANSI/TIA-606-C. Coordinate labeling scheme with Owner and Telecommunications Designer prior labeling.

END OF SECTION 27 11 00

SECTION 27 13 00 - COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 27 05 00 - Common Work Results for Communications.

1.02 SUMMARY

- A. Section Includes:
 - 1. Pathways.
 - 2. UTP cable.
 - 3. Single Mode optical fiber cabling
 - 4. Multi-Mode optical fiber cabling.
 - 5. Coaxial cable.
 - 6. Cable connecting hardware, patch panels, and cross-connects.
 - 7. Cabling identification products.

1.03 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- C. EMI: Electromagnetic interference.
- D. IDC: Insulation displacement connector.
- E. LAN: Local area network.
- F. RCDD: Registered Communications Distribution Designer.
- G. UTP: Unshielded twisted pair.

1.04 BACKBONE CABLING DESCRIPTION

- A. Backbone cabling system shall provide interconnections between communications rooms, main communications room, and entrance facilities in the telecommunications cabling system infrastructure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
- B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.05 PERFORMANCE REQUIREMENTS

- A. General Performance: Backbone cabling system shall comply with transmission standards in ANSI/TIA-568.2-D, when tested according to test procedures of this standard.

1.06 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For coaxial cable, include the following installation data for each type used:
 - a. Nominal OD.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.
- B. Shop Drawings:
 - 1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
 - 2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
 - 3. Cabling administration drawings and printouts.
 - 4. Wiring diagrams to show typical wiring schematics including the following:
 - a. Cross-connects.
 - b. Patch panels.
 - c. Patch cords.
 - 5. Cross-connects and patch panels. Detail mounting assemblies and show elevations and physical relationship between the installed components.
 - 6. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:

- a. Vertical and horizontal offsets and transitions.
- b. Clearances for access above and to side of cable trays.
- c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
- d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

1.07 CLOSEOUT SUBMITTALS

- A. Closeout Submittals “ In accordance with section 27 05 00.

1.08 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings under the supervision of an RCDD.
- B. Telecommunications Pathways and Spaces: Comply with ANSI/TIA-569-E.
- C. Grounding: Comply with ANSI/TIA-607-D.

1.09 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install indoor rated cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.01 UTP CABLE “ INDOOR RATED

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Belden CDT Inc.; Electronics Division.
 - 2. Berk-Tek; a Nexans company.

3. CommScope, Inc.
4. Draka USA.
5. Genesis Cable Products; Honeywell International, Inc.
6. KRONE Incorporated.
7. Mohawk; a division of Belden CDT.
8. Nordex/CDT; a subsidiary of Cable Design Technologies.
9. Superior Essex Inc.
10. SYSTIMAX Solutions; a CommScope Inc. brand.
11. 3M.
12. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
13. Or Approved Equal.

B. Description: 100-ohm UTP, formed into 25-pair binder groups covered with a thermoplastic jacket. Provide total pair count as indicated on drawings.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with ANSI/TIA-568.1-E, Category 3.
3. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications Plenum Rated: Type CMP, complying with NFPA 262.
 - b. Communications Riser Rated: Type CMR, complying with UL 1666.

2.02 UTP CABLE " OUTDOOR RATED

A. Description: 100-ohm UTP, formed into 25-pair binder groups covered, ASP-filled with a black thermoplastic jacket and overall metallic shield utilized for underground conduit or direct buried applications. Provide total pair count as shown on drawings.

1. Voice grade wire and cable placed in the outside environment shall be solid, 24AWG, twisted pair and multi-conductor. The copper twisted pairs shall meet RUS P-89 electrical performance characteristics for exchange cable.
2. Underground cable shall have an aluminum steel polyethylene (ASP) sheath and a core of solid copper conductors, dual insulated with foam skin and plastic, surrounded by water-blocking filling compound suitable for use in underground wet locations.
3. Manufacturer shall be ISO 9001 Certified.
4. Cable shall be UL-listed outdoor use and installed in accordance with the NEC, NESC, ANSI/TIA Standards, BICSI Methods and local codes.
5. Approved Manufacturer: Superior Essex or approved equivalent as submitted for review.

2.03 UTP CABLE HARDWARE " INDOOR RATED

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Technology Systems Industries, Inc.
2. Dynacom Corporation.

3. Hubbell Premise Wiring.
4. KRONE Incorporated.
5. Leviton Voice & Data Division.
6. Molex Premise Networks; a division of Molex, Inc.
7. Nordex/CDT; a subsidiary of Cable Design Technologies.
8. Panduit Corp.
9. Siemon Co. (The).
10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
11. Or Approved Equal.

- B. General Requirements for Cable Connecting Hardware: Comply with ANSI/TIA-568.1-E, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Connecting Blocks: 110-style IDC for Category 5E. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
- E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
- F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- G. Patch Cords: Factory-made 4-pair cables terminated with 8-position modular plug at each end.
 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
 2. Patch cords shall have color-coded boots for circuit identification.
 3. Provide patch cords for 75% of installed.

2.04 UTP CABLE HARDWARE COPPER CABLE SPLICE CLOSURE “ OUTDOOR RATED

- A. Splice Closure for large pair count cables:
 1. Provide a fire retardant re-enterable closure suitable for use indoors and outdoors in underground vaults.
 2. Size the closure to accommodate the maximum quantity of cable pairs that can be spliced using the cable sizes on the drawings. This includes future cable adds to the closure.
 3. Size the closure such that the end plates will accommodate the current quantity of cable entrances and cable diameters plus the additional future cables to be spliced to dead count cable pairs left in the splice closure. Refer to drawings and splice locations.

4. Provide all the required splice closure accessories for a complete, watertight, grounded, re-enterable copper cable splice closure. Accessories shall be from the same manufacturer as the closure.
5. Approved Manufacturer: 3M; Part No. 2-Type 2C2 Series closure, or Preformed Armadillo 8"x28" stainless steel type; or approved equal as submitted for review.

2.05 UTP CABLE HARDWARE COPPER SPLICE CONNECTORS " OUTDOOR RATED

A. Copper Cable Splice Modules:

1. Provide straight/half-tap splice modules in 25 pair sizes.
2. Provide fire retardant modules only in indoor closures.
3. Provide gel filled modules in underground vault closures.
4. Provide modules that use the insulation displacement contact (IDC) method of termination and that accept wire gauges from 22 to 26 AWG.
5. Modules shall include an index strip, the module, and a cap.
6. Approved Manufacturer: 3M; 3M-710 Series, Part No. 3M710-SDI-25 and 3M710-TCI-25; or approved equal as submitted for review.

2.06 OPTICAL FIBER CABLE " INDOOR RATED

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Berk-Tek; a Nexans company.
2. CommScope, Inc.
3. Corning Cable Systems.
4. General Cable Technologies Corporation.
5. Mohawk; a division of Belden CDT.
6. Nordex/CDT; a subsidiary of Cable Design Technologies.
7. Optical Connectivity Solutions Division; Emerson Network Power.
8. Superior Essex Inc.
9. SYSTIMAX Solutions; a CommScope Inc. brand.
10. 3M.
11. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
12. Or Approved Equal.

B. Description: Singlemode, 8.3 micrometer, indoor/outdoor nonconductive, loose tube, optical fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with ANSI/TIA-568.1-E for performance specifications.
3. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - a. Plenum Rated Nonconductive: Type OFNP, complying with NFPA 262.
 - b. Riser Rated Nonconductive: Type OFNR complying with UL 1666.
 - c. Plenum Rated Armored: Type OFCP, complying with NFPA 262.
 - d. Riser Rated Armored: Type OFCR complying with UL 1666.

4. Maximum Attenuation: 3.50 dB/km at 1310 nm; 0.25 dB/km at 1550 nm.
5. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

C. Jacket:

1. Jacket Color: Yellow.
2. Cable cordage jacket, fiber, unit, and group color shall be according to ANSI/TIA-598-B.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

D. Description: Multimode, 50/125-micrometer, OM4, tight buffer, optical fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with ANSI/TIA-568-C.3 for performance specifications.
3. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - a. Plenum Rated Nonconductive: Type OFNP, complying with NFPA 262.
 - b. Riser Rated Nonconductive: Type OFNR complying with UL 1666.
 - c. Plenum Rated Armored: Type OFCP, complying with NFPA 262.
 - d. Riser Rated Armored: Type OFCR complying with UL 1666.
4. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
5. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

E. Jacket:

1. Jacket Color: Aqua for 50/125-micrometer cable.
2. Cable cordage jacket, fiber, unit, and group color shall be according to ANSI/TIA-568.3-D.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

2.07 OPTICAL FIBER CABLE “ OUTDOOR RATED

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Berk-Tek; a Nexans company.
2. CommScope, Inc.
3. Corning Cable Systems.
4. General Cable Technologies Corporation.
5. Mohawk; a division of Belden CDT.
6. Nordex/CDT; a subsidiary of Cable Design Technologies.
7. Optical Connectivity Solutions Division; Emerson Network Power.
8. Superior Essex Inc.
9. SYSTIMAX Solutions; a CommScope Inc. brand.
10. 3M.

11. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
12. Or Approved Equal.

B. Description: Dry water-blocking compound shall be suitable for underground conduit, direct burial and aerial applications. Cable shall not contain gel, filling or flooring compound, grease or other flammable water blocking fluids. The aramid yarns shall be specially prepared with an agent that shall provide waterproof attribute of cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with ANSI/TIA-568.1-E for performance specifications.
3. Maximum Attenuation: 3.50 dB/km at 1310 nm; 0.25 dB/km at 1550 nm.
4. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

C. Jacket:

1. Jacket Color: Black.
2. Cable cordage jacket, fiber, unit, and group color shall be according to ANSI/TIA-568.3-D.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

2.08 OPTICAL FIBER CABLE HARDWARE “ INDOOR AND OUTDOOR RATED

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ADC.
2. American Technology Systems Industries, Inc.
3. Berk-Tek; a Nexans company.
4. Corning Cable Systems.
5. Dynacom Corporation.
6. Hubbell Premise Wiring.
7. Molex Premise Networks; a division of Molex, Inc.
8. Nordex/CDT; a subsidiary of Cable Design Technologies.
9. Optical Connectivity Solutions Division; Emerson Network Power.
10. Siemon Co. (The).
11. Or Approved Equal

B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

C. Patch Cords: Factory-made, dual-fiber cables in 36-inch lengths.

1. Provide patch cords for 75% of installed cables in each color and length indicated above.

D. Cable Connecting Hardware:

1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of EIA/TIA-604-2, EIA /TIA-604-3-A, and EIA/TIA-604-12. Comply with ANSI/TIA-568.3-D.
2. Quick-connect, simplex and duplex, Type LC connectors. Insertion loss not more than 0.75 dB.
3. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.09 COAXIAL CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Alpha Wire Company.
 2. Belden CDT Inc.; Electronics Division.
 3. Coleman Cable, Inc..
 4. CommScope, Inc.
 5. Draka USA.
 6. Or Approved Equal
- B. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
- C. RG-11/U: NFPA 70, Type CATV.
 1. No. 14 AWG, solid, copper-covered steel conductor.
 2. Gas-injected, foam-PE insulation.
 3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
- D. RG-6/U: NFPA 70, Type CATV.
 1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
- E. RG59/U: NFPA 70, Type CATV.
 1. No. 20 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 2. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.

- F. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70, "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:

1. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
2. CATV Riser Rated: Type CATVR, complying with UL 1666.

2.10 COAXIAL CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aim Electronics; a brand of Emerson Electric Co.
2. Leviton Voice & Data Division.
3. Siemon Co. (The).
4. Or Approved Equal.

- B. Coaxial Cable Connectors: Type BNC, 75 ohms.

- C. Coaxial Cable Connectors: F-type, 75 ohms.

2.11 LIGHTNING PROTECTION BUILDING ENTRANCE TERMINALS (BET)

- A. BET Protection Terminals (25, 50, & 100 pair):

1. Wall mountable, sized to accept 25, 50 and 100 pair cable.
2. Accepts 5-pin plug-in protector modules.
3. Equipped with 110 style wiring block for the input cable connections.
4. Equipped with 110 style wiring block for the output connections.
5. Approved Manufacturer: SYSTIMAX SOLUTIONS, 489ACAI-xxx where æxxx equates to the cable size in pair count: or the equivalent CIRCA product or approved equal as submitted for review.

- B. Protector Modules:

1. UL Listed 5-pin plug-in devices.
2. Solid state with heat coils.
3. Provide a quantity to completely fill the BET.
4. Approved Manufacturer: Systimax Solutions, 4C1S, or the equivalent CIRCA product, or approved equal as submitted for review.

2.12 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

- B. Comply with ANSI/TIA-607-D.

2.13 IDENTIFICATION PRODUCTS

- A. Comply with ANSI/TIA-606-C and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Cable will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.02 WIRING METHODS

- A. Provide cable types to match installation environment.
 - 1. Install plenum cable (CMP) in environmental air spaces, including plenum ceilings.
 - 2. In non-plenum indoor installations riser type cable (CMR) is acceptable.
 - 3. In wet, damp, and outdoor environments provide outdoor or indoor/outdoor rated cabling.
 - a. Outdoor rated cable must be terminated within 50 feet of building entry.
- B. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
- C. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- D. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.03 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:

1. Comply with ANSI/TIA-568.1-E.
2. Comply with BICSI ITSIM, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30-inches and not more than 6-inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
10. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
11. Pulling Cable: Comply with BICSI ITSIM, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with ANSI/TIA-568.1-E.
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:

1. Comply with ANSI/TIA-568.1-E.
2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway, a minimum of 8-inches above ceilings by cable supports not more than 48-inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.

2. Install cabling after the flooring system has been installed in raised floor areas.

G. Outdoor Coaxial Cable Installation:

1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
2. Attach antenna lead-in cable to support structure at intervals not exceeding 36-inches.

H. Group connecting hardware for cables into separate logical fields.

I. Separation from EMI Sources:

1. Comply with BICSI TDMM and ANSI/TIA-569-E recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5-inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12--inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24-inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-½-inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6-inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12-inches.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3-inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6-inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48-inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5-inches.

3.04 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."

- B. Comply with ANSI/TIA-569-E, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.05 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI/TIA-607-D.
- C. Comply with 270526, "Grounding and Bonding for Communications Systems".

3.06 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with ANSI/TIA-606-C.
 - 1. Coordinate with Owner and Telecommunications Designer for labeling scheme.
- B. Comply with requirements in Division 09 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- E. Cable and Wire Identification:
 - 1. Label each cable within 4-inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted device is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
 - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15-feet.
 - 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

- a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.
- 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- F. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in ANSI/TIA-606-C, for the following:
 - 1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.07 FIELD QUALITY CONTROL

A. Tests and Inspections:

- 1. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with ANSI/TIA-568-D.
- 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
- 3. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in ANSI/TIA-568.1-E. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- 4. Optical Fiber Cable Tests:
 - a. Test instruments shall meet or exceed applicable requirements in ANSI/TIA-568.1-E. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Link End-to-End Attenuation Tests:
 - 1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to ANSI/TIA-526-14-C, Method B, One Reference Jumper.

- 2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in ANSI/TIA-568.1-E.
- B. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- C. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- D. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 27 13 00

SECTION 27 15 00 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 27 05 00 - Common Work Results for Communications

1.02 SUMMARY

- A. Section Includes:
 - 1. UTP cabling.
 - 2. Coaxial cable.
 - 3. Cable connecting hardware, patch panels, and cross-connects.
 - 4. Telecommunications outlet/connectors.
 - 5. Cabling system identification products.
- B. Related Requirements:
 - 1. Section 271300 "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.

1.03 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
- C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- D. EMI: Electromagnetic interference.
- E. IDC: Insulation displacement connector.
- F. LAN: Local area network.
- G. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

H. RCDD: Registered Communications Distribution Designer.

I. UTP: Unshielded twisted pair.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.

B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.05 SUBMITTALS

A. Product Data: For each type of product.

1. Provide submittals as required in section 27 05 00.

B. Shop Drawings:

1. Provide shop drawings as required in section 27 05 00.

1.06 CLOSEOUT SUBMITTALS

A. Closeout Submittals " In accordance with section 27 05 00.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.

2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install indoor rated cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.01 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.
 - 1. ANSI/TIA-568.1-E requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
 - 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
 - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
 - 4. Splitters shall not be installed as part of the optical fiber cabling.
- B. A work area is approximately 100 sq. ft. and includes the components that extend from the telecommunications outlet/connectors to the station equipment.
- C. The maximum allowable permanent link horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

2.02 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in ANSI/TIA-568.1-E when tested according to test procedures of this standard.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Grounding: Comply with ANSI/TIA-607-D.

2.03 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. ADC.
 - 2. Belden Inc.
 - 3. Berk-Tek; a Nexans company.
 - 4. CommScope, Inc.
 - 5. Draka Cableteq USA.

6. Genesis Cable Products; Honeywell International, Inc.
7. Mohawk; a division of Belden Networking, Inc.
8. Superior Essex Inc.
9. SYSTIMAX Solutions; a CommScope, Inc. brand.
10. 3M Communication Markets Division.
11. Tyco Electronics Corporation; AMP Products.
12. Or Approved Equal.

B. Description: 100-ohm, four-pair UTP, covered with a thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with ANSI/TIA-568.2-D for performance specifications.
3. Comply with ANSI/TIA-568.2-D, Category 6A unless otherwise noted on the drawings.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
 - b. Communications, Riser Rated: Type CMR, complying with UL 1666.

2.04 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. ADC.
2. American Technology Systems Industries, Inc.
3. Belden Inc.
4. Hubbell Premise Wiring.
5. Leviton Commercial Networks Division.
6. Molex Premise Networks; a division of Molex, Inc.
7. Panduit Corp.
8. Siemon Co. (The).
9. Tyco Electronics Corporation; AMP Products.
10. Or Approved Equal

B. General Requirements for Cable Connecting Hardware: Comply with ANSI/TIA-568.2-D, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables, rated Category 6A unless otherwise noted on the drawings.

D. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals, rated Category 6A unless otherwise noted on the drawings.

E. Patch Cords: Factory-made, four-pair cables terminated with eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6A performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall have color-coded boots for circuit identification.
3. Provide patch cords for 75% of installed.

2.05 COAXIAL CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Alpha Wire Company.
 2. Belden CDT Inc.; Electronics Division.
 3. Coleman Cable, Inc..
 4. CommScope, Inc.
 5. Draka USA.
 6. Or Approved Equal
- B. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
- C. RG-11/U: NFPA 70, Type CATV.
 1. No. 14 AWG, solid, copper-covered steel conductor.
 2. Gas-injected, foam-PE insulation.
 3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
- D. RG-6/U: NFPA 70, Type CATV.
 1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
- E. RG59/U: NFPA 70, Type CATV.
 1. No. 20 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 2. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
- F. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70, "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:

1. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
2. CATV Riser Rated: Type CATVR, complying with UL 1666.

2.06 COAXIAL CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Aim Electronics; a brand of Emerson Electric Co.
 2. Leviton Voice & Data Division.
 3. Siemon Co. (The).
 4. Or Approved Equal.
- B. Coaxial Cable Connectors: Type BNC, 75 ohms.
- C. Coaxial Cable Connectors: F-type, 75 ohms.

2.07 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with ANSI/TIA-568.1-E.
- B. Workstation Outlets:
 1. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
 2. Metal Faceplate: Stainless steel, complying with requirements in Section 262726 "Wiring Devices."
 3. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.
 4. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

2.08 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Comply with ANSI/TIA-607-D.

2.09 IDENTIFICATION PRODUCTS

- A. Comply with ANSI/TIA-606-C and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.01 WIRING METHODS

- A. Provide cable types to match installation environment.
 - 1. Install plenum cable (CMP) in environmental air spaces, including plenum ceilings.
 - 2. In non-plenum indoor installations riser type cable (CMR) is acceptable.
 - 3. In wet, damp, and outdoor environments provide outdoor or indoor/outdoor rated cabling.
 - a. Outdoor rated cable must be terminated within 50 feet of building entry.
- B. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters. Conceal pathways and cables except in unfinished spaces.
 - 1. Comply with requirements in Section 270528 "Pathways for Communications Systems."
- C. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- D. Wiring within Enclosures:
 - 1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
 - 2. Install lacing bars and distribution spools.
 - 3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.02 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with ANSI/TIA-568.1-E.
 - 2. Comply with BICSI ITSIM, "Cable Termination Practices."
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
 - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
 - b. Locate consolidation points for UTP at least 49 feet from communications equipment room.

5. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
11. Install a 6-foot- long service loop on each end of cable.
12. Pulling Cable: Comply with BICSI ITSIM, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with ANSI/TIA-568.2-D.
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8-inches above ceilings by cable supports not more than 48-inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.

F. Installation of Cable Routed in Wet Listed locations:

1. Install outdoor or indoor/outdoor rated cable only.
2. Cables must be transitioned from outdoor rated cabling to indoor rated cabling in a consolidation point or terminate on equipment within 50-feet of entering the building.

G. Outdoor Coaxial Cable Installation:

1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
 2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches.
- H. Group connecting hardware for cables into separate logical fields.
- I. Separation from EMI Sources:
1. Comply with BICSI TDMM and ANSI/TIA-569-E for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
 5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.03 FIRESTOPPING

- A. Comply with requirements in Division 07 "Penetration Firestopping."
- B. Comply with ANSI/TIA-569-E, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.04 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI/TIA--607-D.
- C. Comply with Section 27 05 26 æGrounding and Bonding for Communications Systems• .

3.05 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with ANSI/TIA-606-C.
 - 1. Coordinate with Owner and Telecommunications Designer for labeling scheme.
- B. Comply with requirements in Division 09 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Paint and label colors for equipment identification shall comply with ANSI/TIA-606-C.
- D. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of ANSI/TIA-606-C. Furnish electronic record of all drawings, in software and format selected by Owner.
- F. Cable and Wire Identification:
 - 1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
 - 3. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.

4. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in ANSI/TIA-606-C.
1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.06 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with ANSI/TIA-568.1-E.
 2. Visually confirm Category 6A marking of cables, outlet/connectors, and patch panels.
 3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 4. UTP Performance Tests:
 - a. Test for each outlet. Perform the following tests according to ANSI/TIA-568.1-E and ANSI/TIA-568.2-D:
 - 1) Wire map.
 - 2) Length (physical vs. electrical, and length requirements).
 - 3) Insertion loss.
 - 4) Near-end crosstalk (NEXT) loss.
 - 5) Power sum near-end crosstalk (PSNEXT) loss.
 - 6) Equal-level far-end crosstalk (ELFEXT).
 - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
 - 8) Return loss.
 - 9) Propagation delay.
 - 10) Delay skew.
- B. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 27 15 00

SECTION 27 51 13 - PAGING SYSTEMS

PART ? - GENERAL

?.? RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.
- B. Section 27 05 00: Common Work Results for Communications Systems applies to this Section.

?.? DESCRIPTION

- C. Design and provide a complete and fully operational multi-zone system for the pickup, amplification, distribution, and reproduction of voice and/or other audio program material. The system shall be of modular design to facilitate both expansion and service and shall be completely solid state. All necessary hookup and installation shall be by a factory approved representative.
- D. Where speakers are wall mounted, install cabling in conduit from outlet location to accessible ceiling space. Cable in ceiling shall be routed via J-hooks as are specified in Section 27 05 28. Install cables in continuous lengths, no splices are permitted. Routing is not shown on the drawings, and it shall be the responsibility of the sound system supplier to design conduit routing and wiring and to show same on shop drawings.
- E. Paging System shall provide for voice paging in areas shown with recessed ceiling speakers, open ceiling speakers, or wall mounted horns. Provisions shall be made for future background music by providing an additional input on the paging DSP. Attenuators/Volume Controls with priority override shall be provided where shown to prevent disturbance of activities in those areas. Microphones shall be provided where shown on drawings for input to paging system for all-zone paging.
- F. Systems Connected but not Provided Under this Section:
 - 1. Telephone system.
 - 2. Local Area Network

PART ? - PRODUCTS

?.? GENERAL

- G. Equipment shall be new, unused, and undamaged.

- H. All materials shall be new, free from defects and not less than the quality herein specified. Materials shall be designed to insure satisfactory operation and operational life in the environmental conditions which will prevail where they are being installed.
- I. Where these specifications include model or series numbers, the provided equipment (including substitutions) shall meet or exceed the manufacturer™s published specifications for the specified model or series the same as if the manufacturer™s published specifications were enumerated within these project specifications. This requirement is in addition to the other requirements given in the project specifications. This requirement is not intended to apply to characteristics (such as color or appearance) which do not affect the performance, function, or reliability.
- J. All accessories, including mounting hardware, power supplies, etc., shall be obtained from the original equipment manufacturer. Unless otherwise noted or specified, third party accessories shall not be used.
- K. Equality
 - 1. Other products of equal quality and function may be furnished, subject to approval by the Owner, Architect, and Owner's Representative.
 - 2. Proof of equality rests with the submitter. The Owner shall be the final judge of equality.
- L. Manufacturer:
 - 1. Do not provide an assortment. For each category, provide products of the same manufacturer; for each item, provide the same model for all pieces.
- M. Accessories:
 - 1. Any standard accessory or item supplied by the manufacturer as part of the system shall be turned over to the Owner as a loose item at the time of project acceptance.

?.? COMPLETE SYSTEMS

- N. All the systems mentioned shall be complete in every detail and fully operational upon completion of the project unless specifically noted otherwise. Mention of certain materials in these specifications shall not be construed as releasing the Contractor from furnishing such additional materials and performing all labor required to provide complete and fully operational systems.
- O. The paging systems integrator will be responsible for determining the proper equipment compliment to provide complete and working systems, based on the operational requirements set forth in the specification.

?.? MANUFACTURER

- P. This specification is based upon equipment as manufactured by Biamp, Crown, Bogen, TOA and Atlas Sound.

?.? PHYSICAL INSTALLATION

- Q. The equipment in this area shall be as detailed on drawings.
- R. Equipment shall be firmly secured in place unless requirements of portability dictate otherwise.
- S. Equipment shall have an engraved plaque permanently affixed, denoting its function.
- T. Fastenings and supports shall be adequate to support their loads with a safety factor of at least three. Boxes, equipment, etc., shall be secured plumb and square.
- U. In the installation of equipment and cable, consideration shall be given not only to operational efficiency, but also to overall aesthetic factors.
- V. Equipment requiring power (such as line drivers) located in paging system outlet boxes, shall be installed so that power is fed remotely from the main equipment location (i.e. Paging System Rack). Under no circumstances shall a remote device be powered from an adjacent receptacle unless permission has been granted by the Owner's Representative.

?.? EQUIPMENT RACKS

- W. Provide hardware as required to provide finished install of specified racks, doors, rack rails, side panels, top and bottom sections, fans, blank or vented inserts, etc.
 - 1. Where racks are shown together, gang together using factory-provided hardware.
- X. Provide hardware as required for standard 19" rack mounting of equipment.
 - 1. Items that do not include manufacturer-provided rack hardware shall utilize a factory-made clamping rack-mount kit such as the RC or CAP series manufactured by Middle Atlantic Products.
 - 2. There shall not be any unsecured shelf-mounted components in the audiovisual racks.
- Y. Provide blank or vented inserts as required to fill all rack spaces.
 - 1. Provide a minimum of 1 rack unit of vented space at top and bottom of rack.
 - 2. Provide rack blanks for all non used rack spaces. In enclosed spaces provided vented rack blanks to support air circulation in place of solid blanks.

?.? INPUT/OUTPUT OUTLET BOX PLATES

- Z. Provide metal connectorized outlet plates for all boxes where connections are shown on the drawings.
- AA. For boxes shown with no connections, provide a metal plate with grommetted hole for the cables to pass through.

?.? POWER STRIPS/MULTI-OUTLET ASSEMBLIES

- BB. Provide switchable plug strips or multi-outlet assemblies as required to connect AC power to all associated equipment in racks, equipment consoles and custom mounting enclosures. Provide a minimum of one plug strip or multi-outlet assembly per rack and per power circuit.
- CC. Where applicable use rack manufacturer part or plug strip kit.

?.? CABLE

- DD. Provide wire and cables which are UL-listed and marked for their Class of wiring, per NEC.
- EE. Trade numbers shown below are for general-purpose cables for use in raceway and where otherwise allowed by NEC and other codes. Prior to installation, the Contractor shall verify, for each installation situation, with the local authority having jurisdiction that non-plenum and non-riser rated cables are acceptable. In the event that plenum or riser-rated cables are required, provide cables so rated with equivalent electrical characteristics to those specified below.
- FF. Audio cable shall be Belden 9451 (Non-Plenum), Belden 82761 (Plenum), or approved equivalent.
- GG. Speaker cable for 70-volt lines shall be Belden 5300UE (Non-Plenum), Belden 6300UE (Plenum), or approved equivalent.
- HH. Speaker cable for 4, 8, or 16 ohm circuits shall be Belden 5000UE (Non-Plenum), Belden 6000UE (Plenum), or approved equivalent.
- II. Cat5E cable for control and network shall be Belden 1583P (Non-Plenum), Belden 1583P (Plenum), or approved equivalent.
- JJ. Provide multi-conductor control cable with wire size and number of conductors as recommended by the manufacturer and as required for the distance of run and required functions, for remote controlled devices.
- KK. Control cable shall be shielded with color coded conductors, except where other types are specifically recommended by the manufacturer as the optimal type.

- LL. Color-coding shall conform to the NEC color coding standard for all multi pin connector wiring.
- MM. Cable substitutions from Liberty, Gepco, West Penn, Commscope, and equivalent will be considered.

?.? CONNECTORS

- NN. Balanced audio connectors shall be 3-conductor, gold plated XLR type. Connector shell connection isolated. Neutrik equivalent.
- OO. Unbalanced audio connectors for both RCA and 1/4" phone and balanced 1/4" phone shall have metal case and solder connections for connecting wire to plug contact type Neutrik equivalent.
- PP. RJ-45 data style connectors for nonpermanent installations shall have metal case with quick-lock release. Neutrik NE8 Series equivalent.

?.? RACEWAY AND OUTLET BOXES.

- QQ. Raceway and outlet boxes shall be as specified in Section 27 05 28 " Communications Pathways.
- RR. Outlet boxes for wall mounted speakers shall be minimum 4" square deep boxes with single gang mud ring.
- SS. Raceways shall conform to other sections of the specifications except that conduit bends shall be long radius, as necessary to conform to the cable requirements, and shall be 3/4" trade size unless shown to be larger on drawings.
- TT. Provide minimum 1" raceway for cables between floors.

PART ? - EXECUTION

?.? CUTTING BUILDING CONSTRUCTION

- UU. Obtain permission from the Architect or Owner and coordinate with other trades prior to cutting. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. Cut concrete with diamond core drills or concrete saws except where space limitations prevent the use of such tools.
- VV. All construction materials damaged or cut into during the installation of this work must be repaired or replaced with materials of like kind and quality as original materials by skilled labor experienced in that particular building trade.

?.? PENETRATIONS OF FIRE RATED ELEMENTS

- WW. Must be provided such as to retain that rating in accordance with Division 7 Firestopping.

?.? PAINTING / FINISHES

- XX. Verify connection faceplates, equipment, mount finishes outside equipment racks in public areas are acceptable and approved by the Architect prior to purchase and installation.
- YY. Painting will generally be provided by the General Contractor, except for refinishing of items furnished under this Division which are scratched or marred in shipment or installation.

?.? CLEAN UP

- ZZ. Contractor shall continually remove debris, cuttings, crates, cartons, etc., created by his work. Such clean up shall be done daily and at sufficient frequency to eliminate hazard to the public, other workmen, the building or the Owner's employees. Before acceptance of the installation, Contractor shall carefully clean cabinets, panels, lighting fixtures, wiring devices, cover plates, etc., to remove dirt, cuttings, paint, plaster, mortar, concrete, etc. Blemishes to finished surfaces of apparatus shall be removed and new finish equal to the original applied.
- AAA. Clean equipment to remove plaster, taping or patching compound, overspray, paint spills, oil, grease, dust, fingerprints, or other dirt or contaminants to restore equipment to original finish and condition.
- BBB. Remove dirt and debris from the interior of enclosures, outlet boxes, pull and junction boxes, and equipment cabinets.

?.? WORKMANSHIP AND OBSERVATION

- CCC. Workmanship shall be of the best quality and none but competent and experienced Paging Contractors shall be employed and shall be under the supervision of a competent and experienced foreman.
- DDD. Completed work shall represent a neat and orderly appearance.
- EEE. All work and materials shall be subject to observation at any and all times by representatives of the Architect and Owner's Representative.

FFF. The contractor shall keep the job adequately staffed at all times, including a designated field supervisor present at the job site, and in responsible charge during all phases of installation and checkout. This supervisor shall be the same individual throughout the execution of the work, unless illness, loss of personnel, or other circumstances beyond the control of the contractor intervene.

?.? INSTALLATION

GGG. Verify performance of each and every item of equipment to be equal to or better than factory specifications. Repair or replace items or components that do not meet factory specifications.

HHH. Boxes, equipment, etc. shall be plumb and square.

III. Equipment (except portable equipment) shall be firmly held in place. Fastenings and supports shall be adequate to support their loads with a safety factor of at least three. Equipment shall be braced for seismic conditions according to applicable codes and regulations.

?.? EQUIPMENT MOUNTING

JJJ. Wall Loudspeakers:

1. Mount outlet box and speaker to wall at 18" BFC. Do not mount where speaker will be obstructed by other wall or ceiling mounted device such as HVAC ductwork.
2. Verify polarity of each speaker voice coil prior to installation and connect to maintain uniform polarity.
3. Tap 70 volt transformers to provide an amplifier load between 60% and 90% of rated capacity with all speaker-line attenuators (if any) set for minimum attenuation.

KKK. Ceiling Loudspeakers:

1. Do not support flush speaker enclosures with lay-in tiles or GWB. Provide adequate support (using attachments to structural elements and/or metal mounting bars) for back-boxes so that no perceptible sag will occur once speaker and grille are mounted. Seismic connections to structure alone shall not constitute speaker support.
2. Mount surface ceiling speakers in unfinished (open) ceiling areas per manufacturer's instructions. In general, mount so speaker bottom is 10' AFF in single story areas and so bottom is 4' BFC in double height spaces. Do not mount lower than the lowest hanging devices in the same area such as lighting. In areas where other devices hang from ceiling, mount so that bottom of speaker is on the same plane as the bottom of other lowest hanging device.
3. Verify polarity of each speaker voice coil prior to installation and connect to maintain uniform polarity.

4. Tap 70 volt transformers to provide an amplifier load between 60% and 90% of rated capacity with all speaker-line attenuators (if any) set for minimum attenuation.
5. Tap surface ceiling speakers twice as high as flush ceiling speakers in the same area. For example if flush ceiling speakers are tapped at 1 watt, tap surface ceiling speakers at 2 watts.
6. For flush ceiling speakers, install speaker and baffles to provide tight seal with ceiling and enclosure. Do not caulk baffle to ceiling.
7. Install so speaker grille is centered in tile or building element, with sides of grille or line between mounting fasteners parallel to ceiling grid or building lines unless directed otherwise.

LLL. Attenuators and Volume Controls

1. Priority override volume controls shall be wired so that priority pages bypass the volume control and associated speakers are not affected by volume control settings.

MMM. Rack-mounted equipment:

1. Install vent panels between amplifiers if recommended by the manufacturer.
2. Install blank panels to fill any unused rack spaces.
3. Separate heat producing equipment by at least one rack unit and install blank(s) as required.
4. Mount mixers, controls, and patch panels at working height.
5. Within racks, install cables and wiring neatly, forming straight lines and smooth corners. Bundle separately, or install in separate plastic ducts, the microphone, line-level audio, speaker, control, video, and power wiring.

NNN. Seismic Restraints:

1. All hanging or free standing equipment and cabinets provided under this contract shall be secured to substantial building structure to resist seismic acceleration in any direction up to 1.0G, or the limit proscribed by governing codes.
2. Paging system equipment hanging details, rack bracing, and other seismic restraints are not shown on the contract documents. The Contractor is responsible for all seismic restraints.
3. Seismic restraints shall not interfere with the maintenance or service of Paging system devices.

OOO. Americans with Disabilities Act

1. Mount all equipment per ADA requirements.

?.? WIRING

PPP. To the greatest extent possible, install wire and cable only within the raceway systems being provided under Section 27 05 28.33 Conduits and Backboxes for Communication Systems. Do not install wire or cable in wall cavities or ceiling plenums/attic spaces without the use of raceway (conduit or cable tray), without the explicit written permission of the Owner's Representative, or as otherwise noted on the drawings.

1. Wiring for loudspeakers may be installed with or without conduit/raceway. Where installed without raceway, provide plenum-rated wiring where required.

QQQ. Maintain conduit fills equal to or less than those given by Table 1 of Chapter 9 of the NEC, regardless of the class of wiring.

RRR. Cables shall be grouped according to the signals being carried. In order to reduce signal contamination, separate groups shall be formed for the following cable families:

1. Power cables
2. Control cables
3. Audio cables carrying signals less than " 20 dBm
4. Audio cables carrying signals between " 20 dBm and +20 dBm
5. Audio cables carrying signals above +20 dBm

SSS. As a general practice, all power cables, control cables, and high level cables shall be run on the left side of an equipment rack as viewed from the rear. All other cables shall be run on the right side of an equipment rack, as viewed from the rear.

TTT. Protect installed conductors from painting, overspray, and taping or patching compounds.

UUU. Number or color code each cable. Number or color code individual conductors of cables to identify circuits and connections.

VVV. Record number and color codes on the "RECORD SET" drawings.

WWW. Cables ties shall be placed at appropriate intervals of no greater than six inches for vertical bundles, two inches for horizontal bundles.

XXX. Do not use cable ties in the cable tray or overhead junction boxes.

YYY. Cable assemblies shall utilize a service loop so that equipment in racks or equipment consoles can be fully pulled out for service without cutting wire ties or putting undue stress on cable assemblies.

ZZZ. Cable assemblies run in conduit and/or cable trays should provide for a minimum of 3 feet of excess cable on each end to allow for relocation of equipment or re-termination of cable in the future.

AAAA.All vertical cable bundles shall be attached to the rack frame.

BBBB.Cables shall be continuous lengths without splices. All system wire, after being cut and stripped, shall have the wire strands twisted back to their original lay and be terminated by approved soldered or mechanical means. Except where noted otherwise in the specifications, NO BARE WIRE TERMINATIONS WILL BE ACCEPTED unless specifically directed by the manufacturer. Heat-shrink tubing shall be used to insulate the ground or drain wire. Unused wires at the end of a cable shall remain unstripped and shall be laid back and held in place with wire ties.

CCCC. Prior to connection, verify freedom from shorts or grounds of all conductors (including shields and drain wires) of all cables.

DDDD. Solder connections shall be made with rosin-core solder using temperature-controlled solder stations. Care shall be taken to avoid cold or cracked solder joints. Any connections which do not appear to be clean and shiny, or which show signs of cracking, shall be resoldered by the Contractor before final acceptance of the system.

EEEE.Connections made with screw actuated pressure type terminal strips shall be made by stripping approximately 1/4 inch of insulation from the stranded conductor. Then the un-tinned wire shall be inserted into the terminal and the screw tightened using a secure fitting precision screwdriver.

FFFF.For all crimp-type connectors and pins, utilize only crimp tools rated for the crimp pin type, size and wire gage being assembled. Consult the manufacturer™s specifications and recommendations for crimping.

GGGG. Utilize only gold-plated crimp pins.

HHHH. Cables shall have proper connector housing.

IIII. Cables shall not protrude from the back of racks.

JJJJ. Cable entry shall be through the tops of racks or through entrance holes in the base of the rack. No cable shall enter racks through front, rear or side panel openings.

?.? LABELING

KKKK.Label cables on each end, with number and identification legend clearly identifying the connection point for the cable end. Labels shall be self-laminating type, such as Panduit PDL-54 or PDL-56.

?.? GROUNDING AND SHIELDING

LLLL. Rack Grounding

1. Prior to installing or connecting equipment, temporarily disconnect ground wires from equipment cabinet(s), and measure impedance between each ground wire and its cabinet. Verify electrical isolation (minimum resistance of 1 mega-ohm) between rack cabinets and raceway and conductive structure. Record results for test report. Reconnect ground wires.
- MMMM. Install a single-point grounding system for each system. Where multiple systems are installed in a single grouping of racks, they shall be considered one system for grounding purposes.
- NNNN. Verify integrity of grounding systems and isolated receptacles prior to connection of equipment.
- OOOO. Connect shield and grounding conductors as follows:
1. Insulate shields from connector shell, plates, boxes, and raceway.
 2. Connect shields of wiring from patch panel to control console inputs only to control console (insulate at patch panel).
 3. Connect shields of balanced line level circuits at patch panel only; insulate at other end. For balanced circuits that do not terminate on patch panel, connect shields at input ends only; insulate at output ends. Use this standard as needed to correct ground hum issues
- PPPP. Maintain shield and drain wire continuity through junction boxes and intermediate termination points. Insulate shields from raceway or other conductive building elements. Maintain shields to within 3 inches of connected devices, and maintain twisting of pairs of wires to within 1/2 inch of connector or device termination.
- QQQQ. Make any modifications to grounding and shielding which are necessary to eliminate extraneous noise and RFI, prevent oscillations, parasitics, and other signal instabilities, and to meet overall systems noise specifications. Record any deviations from the above guidelines, and the reasons that each deviation was deemed necessary.
- RRRR. Do not remove or defeat grounding terminal of 3 conductor power cords, and maintain safety grounding and bonding as required by the NEC.
- SSSS. The overall governing requirements are that the wiring systems shall not induce or pick up perceptible noise, and that the predominant components of the noise floor of all signal paths shall be normal "thermal" noise of the upstream devices.
- TTTT. Because of the great number of possible variations in grounding systems, it shall be the responsibility of the Contractor to follow manufacturer's guidelines and good engineering practice, as outlined above, and to deviate from these practices only when necessary to minimize crosstalk and to maximize signal-to-noise ratios in the audio, video, and control systems.

?.? CONNECTIONS

UUUU. All audio circuits shall be balanced (high, low, shield) except where otherwise indicated. Balance boxes shall be used to convert unbalanced equipment to balanced, where necessary to conform to a balanced standard.

VVVV. Wire all three and five pin audio connectors and quarter-inch phone jacks (mono and stereo) in accordance with IEC-268.

1. For three pin connectors, Pin 1 is ground, Pin 2 is positive, and Pin 3 is negative.
2. For five pin connectors, Pin 1 is ground, Pin 2 is left positive, Pin 3 is left negative, Pin 4 is right positive, and Pin 5 is right negative.
3. For quarter-inch stereo phone jacks, Tip is positive, Ring is negative, and Sleeve is ground.
4. For quarter-inch mono phone jacks, Tip is positive and Sleeve is ground.

WWWW. Connections:

1. Splice only in accessible junction boxes, using insulated crimp-on connectors, wire-nuts, or other methods approved by the Engineer. Do not splice in conduits or cable tray.
2. Make connections to plugs, receptacles, connectors, or solder terminals using rosin-core solder. Make connections to screw connections using insulated spade lugs.
 - a. Ensure that no uninsulated wire is exposed beyond its pin.
 - b. Utilize only multi-core flux resin with 60/40 tin-lead non-corrosive construction, designed for electronic equipment use.
 - c. Soldering shall utilize good engineering practices, and completed solder connections shall appear shiny and smooth with no visible imperfections or cold-solder joints.
3. Serve shielded cables with heat shrink tubing to insulate shield and drain wire.
4. Cable jacket shall be fully engaged by the strain relief of the connector.

?.? LABELING

XXXX. Label cables on each end, with number and identification legend clearly identifying the connection point for the cable end. Labels shall be self-laminating type, such as Panduit PDL-54 or PDL-56. Labels shall be sized and placed so that they are clearly visible and readable after final installation and dressing.

1. Do not place label closer than one (1) inch from cable end.
2. [For patch bays to meet the above visibility and readability specification, do not place label closer than eight (8) inches from cable end.]

YYYY. Clearly label input and output jacks and receptacles with engraved lettering. Labeling will include type of receptacle (MIC, LINE, AUX) and input number. Use of lamacoid labels, press-on, or Kroy-style labels is not acceptable.

ZZZZ. Clearly label equipment to identify the equipment number and designator. This label shall be visible on the front and back of each piece of equipment.

1. Lettering should be of adequate size to be legible from a distance of at least 3 feet.
2. Labels should be applied to equipment so that they can be removed without damaging the equipment but will remain intact under normal operation or servicing.
3. Equipment labels shall be approved by the Owner prior to installation.

?.? PERFORMANCE STANDARDS

AAAAA. Unless restricted by the published specifications of a particular piece of equipment, or unless otherwise required under the Detailed Specifications, the following performance standards shall be met by each system:

1. Audio

Frequency Response:	Within +/- 0.5dB from 20Hz to 20kHz
---------------------	-------------------------------------

Signal to Noise Ratio (including crosstalk and hum at all input/output levels)	>90dB
--	-------

Total Harmonic Distortion	0.05% maximum from 20Hz to 20kHz
---------------------------	----------------------------------

Input Levels

Microphone (Nominal)	-50dBu
----------------------	--------

Overload (Minimum gain)	-5dBu
-------------------------	-------

Maximum Gain	-26dBu
--------------	--------

Line (Nominal)	+4dBu
----------------	-------

Overload (Minimum gain)	+24dBu
-------------------------	--------

Maximum Gain	+9dBu
--------------	-------

Input Common Mode Rejection	>100dB
-----------------------------	--------

Output Levels

Line (Nominal)	+4dBu
----------------	-------

Line (Maximum)	+24dBu
Output Impedance	<0.5 ohms
Load Impedance	>150 ohms

?.? TESTING

BBBBB. Perform testing in accordance with other Sections of Division 27.

CCCCC. Testing and adjustment of equipment shall be performed by qualified technicians with prior knowledge of the particular items of equipment, and general knowledge of audio systems alignment and trouble shooting, and knowledge of the specific systems and installations of this project.

DDDDD. All manufacturers' maintenance or alignment manuals shall be present during testing and adjustment procedures.

EEEEEE. Measurements and Performance Testing

1. Audio:

- a. Measure and record impedance of each speaker load at the main junction box or rack cabinet and total load on each amplifier. At a minimum, make measurements at 100, 1000, and 10,000 Hertz.
- b. Make corrections as required so that the load impedance of each amp is equal to or greater than rated load impedance.
- c. Slowly sweep all low frequency and full range speaker systems with sine waves at 25% of rated maximum amplifier power output, or at 50% of rated continuous power capacity of loudspeakers, whichever is less, from 20 to 2000 Hertz. Observe for audible or perceptible vibration or rattling of speaker components, mounting apparatus, or building elements. Under this Section, correct vibration or rattling of speakers or mounting apparatus to the satisfaction of the Engineer. Report vibration or rattling of other building elements to the Engineer; include frequency, characterization of observed rattling or vibration, and recommendations for correcting the rattling or vibration in the report.
- d. For each system, measure and record the following:
 - 1) Acoustic frequency response at three locations in each listening area.
 - 2) Acoustic noise floor with all microphone inputs at full gain, or at gain settings which correspond to the onset of ringing for a single microphone, whichever is lower gain, and other controls at normal settings. During test, terminate microphone receptacles with 200 ohm resistors.
 - 3) Maximum sound pressure level of pink noise at onset of amplifier clipping. Make measurement using both A-weighted and unweighted (flat) settings of the Sound Level Meter (SLM).

- 4) Perform tests with the measuring microphone at the seated ear height of the audience, within designated seating areas. All interior finishes and furnishings shall be in place during measurements.

e. Make the above measurements for all loudspeaker systems.

FFFFF. Adjustments

1. Audio signals:

- a. Verify that all microphones have the same polarity of output for positive pressure at diaphragm.
- b. Verify that positive pressure at a microphone produces positive pressure from each loudspeaker. Reverse polarity if required, and record which circuit was reversed.
- c. Verify that signal polarity is correct for each circuit and path, and consistent for all circuits and paths. Reverse polarity if required, and record which circuit was reversed.
- d. Adjust gain controls so all components except power amplifiers reach rated nominal output simultaneously. For components which have rated maximum outputs between 18 and 25dBm and line level inputs, adjust each component for unity gain (i.e., assume all such components have rated outputs equal to 20dBm, and nominal outputs of 0dBm).
- e. Set audio distribution amplifiers for unity gain unless otherwise specified by the Engineer.
- f. Adjust power amplifier gains so power amplifiers reach clipping at 10 decibels above 0 volume units on the control console output meter.
- g. Re-adjust gains if required for proper operation of each system and component. Measure and record any such re-adjustments; also record the reason adjustment was deemed necessary.
- h. Adjust equalizers to optimize the specified frequency responses.
- i. Perform final equalization in the presence of the Engineer.
- j. Adjust automatic mixers, automatic level controllers, and other signal processors to optimize use of microphones for teleconferencing with speech using the expected (normal) microphone positions.
- k. Measure and record the overall frequency response and signal to noise of each complete signal path.
- l. Verify that the system is completely free from hum, noise, parasitic oscillation, and RFI.

?.? SYSTEM ACCEPTANCE TESTS

GGGGG. System Acceptance Tests will not be performed until the Contractor™s System Checkout has been completed and the test results have been reviewed. The System Acceptance Tests will be supervised by the Consultant and will consist of the following:

HHHHH. A physical inventory will be taken of all equipment on site and will be compared to equipment lists in the contract documents.

IIIII. The operation of all system equipment shall be demonstrated by the Contractor.

JJJJJ. The operation of the control systems / touch panels will be reviewed for acceptance by the Owner.

KKKKK. Both subjective and objective tests will be required by the Owner's Representative to determine compliance with the specifications. The Contractor shall be responsible for providing test equipment for these tests.

LLLLL. All final, as-built drawings, run sheets, manuals, and other required documents, as detailed in Section 27510, shall be on hand. Two complete sets of these documents shall be delivered to the Owner at this time. (One complete set shall have been delivered to the Owner's Representative prior to the scheduling of Acceptance Tests).

MMMMM. In the event further adjustment is required, or defective equipment must be repaired or replaced, tests may be suspended or continued at the option of the Owner's Representative.

NNNNN. Any charge for additional time incurred by the Owner's Representative required to oversee the system tests, due to improper system installation or previous failed systems, shall be the responsibility of, and charged directly to the Contractor.

End of Section 27 51 13

PART 1 - SECTION 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 2 - - GENERAL

2.01 RELATED DOCUMENTS

- A. Division 1 - All Sections;
- B. Division 8 - Door Hardware;
- C. Division 26 " Electrical for Raceways, Conduit and Power Interfaces;
- D. Division 27 - Communications Cabling;
- E. Division 28 " Conductors and Cables for Electronic Safety and Security
- F. Division 28 - Section 28 13 00 - Access Control;
- G. Division 28 - Section 28 23 00 - Video Surveillance; and
- H. Attendant Contract Drawings.

2.02 APPLICABLE CODES AND STANDARDS

- A. Intent: It is not the intent of this Section to provide all details of design and fabrication. The Contractor shall ensure that equipment has been designed and fabricated in accordance with applicable engineering codes and standards.
- B. Current Standards: This Section is based on the latest codes and standards in force at the time the Specification is issued for bid.

2.03 REFERENCES

- A. General: The publications listed below form a part of this Specification to the extent referenced and are intended to establish a level of performance. It is the responsibility of the Contractor to bring any conflicts to the attention of, or request clarifications of, the Owner prior to the start of work. The publications are referred to in the text by the basic designation only. Where standards and publications are identified, they shall be the most current version.
 - 1. American National Standards Institute (ANSI) Publications:
 - 2. C2 National Electrical Safety Code
 - 3. WC 66 ANSI/NEMA Performance Standard for Cat 6 & 7 100 Ohm Shielded and Unshielded Twisted Pair Cables

4. X3.64 Additional Controls for Use by American National Standard Code for Information Exchange
5. X3.92 Data Encryption Standard
6. X3.154 Office Machines & Supplies - Alphanumeric Machines / Keyboard Arrangement
7. American Society for Testing and Materials (ASTM) Publications:
8. F 967-87 Standard Practice for Security Engineering Symbols
9. Building Officials & Code Administrators (BOCA) International, Inc.:
10. The BOCA National Building Code, Fourteenth edition, 1999
11. Communications Specific:
12. ANSI/TIA-526-7-A: Measurement of Optical Power Loss of Installed Single-mode Fiber Cable Plant.
13. ANSI/TIA-526-14-C: Measurement of Optical Power Loss of Installed Multimode Fiber Cable Plant.
14. ANSI/TIA-568.0-D: Generic Telecommunications Cabling for Customer Premises.
15. ANSI/TIA-568.1-D: Commercial Building Telecommunications Infrastructure Standard
16. ANSI/TIA-568-2.D: Balanced Twisted Pair Telecommunications Cabling and Components Standards
17. ANSI/TIA-568.3-D: Optical Fiber Cabling Components Standard
18. ANSI/TIA-568.4-D: Broadband Coaxial Cabling and Components Standard.
19. ANSI/TIA-569-D: Telecommunications Pathways and Spaces
20. ANSI/TIA-606-C: Administration Standard for Telecommunications Infrastructure
21. ANSI/TIA-607-C: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
22. ANSI/TIA-758-B: Customer-owned Outside Plant Telecommunications Infrastructure Standard
23. ANSI/TIA-862-B: Structured Cabling Infrastructure Standard for Intelligent Building Systems
24. ANSI/TIA-942-B: Telecommunications Infrastructure Standard for Data Centers
25. ANSI/TIA-1179-A: Healthcare Facility Telecommunications Infrastructure Standard
26. ANSI/TIA-4966: Telecommunications Infrastructure Standard for Educational Facilities
27. TIA: Technical Service Bulletins (TSBs) (related to the above ANSI/TIA standards)
28. IEEE 802.11 Wireless Local Area Network Standard, including the IEEE 802.11a, 802.11b, 802.11g, and 802.11n standards
29. BICSI: BICSI Customer Owned Outside Plant Design Manual, Latest Edition
30. BICSI: BICSI LAN and Internetworking Design Manual, Latest Edition
31. BICSI: BICSI Telecommunications Distribution Methods Manual, Latest Edition
32. BICSI: BICSI Telecommunications Cabling Installation Manual, Latest Edition
33. NEC: NFPA 70
34. FCC Part 68: Connection of Terminal Equipment to Telephone Network. Federal Communications Commission (FCC) Publications:
35. CFR 47 Part 15 Radio Frequency Devices
36. CFR Part 90 Rules and Regulations
37. Institute of Electrical and Electronics Engineers (IEEE)
38. C62.41 Surge Voltages in Low Voltage AC Power Circuits

39. 100 Standard Dictionary of Electrical and Electronics terms
40. 142 Recommended Practice for Grounding of Industrial and Commercial Power Systems
41. International Organization for Standardization (ISO) Publications:
42. Identification Cards - Physical Characteristics
43. Identification Cards - Integrated Circuit(s) Cards with Contacts
44. 9000:2000 Quality Management Systems - Requirements (formerly ISO 9001)
45. 14443 Identification Cards - Contactless Integrated Circuit(s) Cards - Proximity Cards
46. 15693 Identification Cards - Contactless Integrated Circuit(s) Cards - Vicinity Cards
47. National Fire Protection Association (NFPA) Publications:
48. National Electrical Code
49. 101 Life Safety Code (Chapter 5 - 1997)
50. National Electrical Manufacturers Association (NEMA) Publications:
51. ICS-1 Industrial Controls and Systems
52. ICSZ-83 Industrial Control Devices and Assemblies
53. ICS-6 Enclosures for Industrial Controls and Systems
54. ICSG-83 Enclosures for Industrial Controls and Systems
55. 250 Enclosures for Electrical Equipment
56. Underwriters Laboratories, Inc., Standard for Safety:
57. UL 5 Surface Metal Raceways and Fittings
58. UL 6 Rigid Metal Conduit
59. UL 50 Cabinets and Boxes
60. UL 65 Electric Wired Cabinets
61. UL 83 Thermoplastic-Insulated Wires
62. UL 96 Lightning Protection Components
63. UL 193 Fuses
64. UL 294 Access Control System Units
65. UL 437 Key Locks
66. UL 444 Communication Cables
67. UL 486A/B Wire Connectors and Soldering Lugs
68. UL 493 Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables
69. UL 497B Protectors for Data Communication and Fire Alarm Circuits
70. UL 512 Fuse Holders
71. UL 514A Boxes, Metallic Outlet
72. UL 514B Boxes, Fittings for Conduit and Outlets
73. UL 603 Power Supplies For Use with Burglar-Alarm Systems
74. UL 609 Local Burglar-Alarm Units and Systems
75. UL 611 Central-Station Burglar-Alarm Systems
76. UL 632 Electrically Actuated Transmitters
77. UL 634 Connectors and Switches For Use With Burglar-Alarm Systems
78. UL 639 Intrusion Detection Units
79. UL 651 Conduit, Schedule 40 and 80 Rigid PVC
80. UL 651A Conduit, Type EB and A Rigid PVC and HDPE Conduit
81. UL 681 Installation and Clarification of Burglar and Hold Up Alarm Systems
82. UL 796 Electrical Printed Wiring Boards
83. UL 797 Electrical Metallic Tubing
84. UL 827 Central Stations For Watchman, Fire-Alarm, and Supervisory Services

- 85. UL 1037 Anti-Theft Alarms and Devices
- 86. UL 1076 Proprietary Burglar Alarm Units and Systems
- 87. UL 1373 Boxes, Termination
- 88. UL 1950 Standard for Safety for Information Technology Equipment
- 89. Applicable federal, state and local laws, regulations, ordinances, and codes.

- B. The referenced codes establish a minimum level of requirements. Where provision of the various codes conflict with each other, the more stringent provision shall govern. If any conflict occurs between referenced codes and this specification, the codes are to govern. Compliance with code requirements shall not be construed as relieving the Contractor from complying with any requirements of the drawings or specifications which may be in excess of requirements of the governing codes and rules and not contrary to same.

2.04 DEFINITIONS

- A. General: The following definitions are applicable to electronic security work within Division 27 and 28. Conflicts between these definitions and any other definitions presented within any Contract Document, as well as inquiries about the intent or meaning of definitions, shall be promptly brought to the attention of the Owner. Should conflicts exist between these definitions and the definitions found in the project General Conditions, the more stringent definition shall govern.
 - 1. Acceptable Manufacturer: Where this term is used it is intended to denote specific manufacturers qualified to provide the products specified.
 - 2. General Contractor: The General Contractor is the company, and/or its duly appointed representative, which/who has responsible charge of the construction portion of the Project.
 - 3. Security Contractor: This term designates the company which conducts the Work and is responsible to ensure that others provide specified Work as described in the Specifications for security systems within Division 26, 27, 28 and other related Divisions and Sections of the Specification. This term specifically refers to a company that is qualified to perform the Work specified herein related to the integration of all electronic security access control and surveillance systems and components and the fabrication and installation of all security equipment. The term "Security Contractor" used herein shall be understood to be synonymous with trade "Contractor."
 - 4. Test: "Test" implies the systematic exercising of an item or system under all specified conditions with quantitative measurement of specified parameters and comparison of performance against the quantitative standards set forth.

2.05 SUMMARY OF WORK

- A. Subcontracted Work/Security Contractor:
 - 1. The Security Contractor shall be responsible for the Work cited herein.

2. The Security Contractor shall be a specialist in and shall be primarily engaged in furnishing, fabricating and installing security equipment specified herein. Further, the Security Contractor shall be a specialist in and shall be primarily engaged in furnishing, fabricating and installing electronic security access control and monitoring systems for facilities as specified herein. Contractor must meet the minimum qualifications specified in the IFB front end documents.
3. A single firm shall be responsible for all electronic security access control systems integration Work.

B. Scope of the Work includes furnishing and installing the following:

1. The Security Contractor's Work shall include the furnishing and installation of security systems, equipment and materials described by the Specification, but in particular by pertinent sections within Division 28, 27, and 26 of the Specification, as well as Drawings attendant to Division 28, 27, and 26.
2. A fully integrated security system shall be installed, documented and tested, satisfactory to the Owner.
3. The integrated security system shall include:
 - a. Access Control and Monitoring systems
 - b. Video Surveillance System
 - c. Power Supplies
4. The scope of the project shall include line supervision of all communication circuits between the operator consoles, control stations, local panels, and remote sensors. The Work shall include the furnishing and installation of security system components, interconnecting conductors, fiber optic and coaxial cabling (if required), termination of security system signals and communications, power distribution, interconnecting conduits and raceways, and the testing of all integrated system components, including those furnished by Others which become part of the integrated system (except for the conductors/cables associated with high voltage power, which will be furnished, installed and terminated by the Electrical Contractor). Security Contractor shall furnish and install all other security system interconnecting wires and/or fiber optic cabling.
5. Associated installation support, including the furnishing and installing of conduits, junction boxes, primary electrical power feeds and cables, associated raceways, and electrical distribution panels, shall be provided by the Electrical Contractor. Conductors shall be clearly marked and shall be terminated onto terminal strips in termination cabinets. Security Contractor shall furnish and install all other security system interconnecting conduits, junction boxes, outlet boxes, and electrical troughs. Security conduits shall be installed with a nylon pull string inside for the installation of interconnecting conductors. All conduits containing fiber optic cabling shall be installed with innerducts.

C. Major Responsibilities of Security Contractor and Coordination With Other Trades:

1. The Security Contractor shall study the entire Specification, both written and illustrated, of the entire Project. Conflicts, if any, must be immediately brought to the attention of the Owner prior to the start of Work. The Security Contractor shall examine the Drawings and Specifications of other trades whose work may influence the installation of the security systems. The Security Contractor shall include in his bid all services attributed to coordinating the installation of the security system with the Work of other trades. Prior to the start of Work, the Security Contractor shall review the Project Drawings and Specifications and shall coordinate his Work with that of the Electrical Contractor and other trades. In particular, the Security Contractor shall coordinate such Work as, including but not limited to, the following:
 - a. AC power feeds;
 - b. electric power distribution panels;
 - c. wiring and conductors;
 - d. fiber optic outdoor cable plant;
 - e. conduit and raceway systems;
 - f. junction boxes, back boxes and enclosures; and
 - g. terminations for supply of power for the security system components.
 - h. Questions shall be promptly submitted to the Owner as Requests for Information (RFIs).
2. Special attention is called to the following items. Coordinate all conflicts prior to installation:
 - a. Location of grilles, pipes, sprinkler heads, ducts and other mechanical equipment so that all communications outlets and equipment are clear from and in proper relation to these items.
 - b. Location of cabinets, counters and doors so that communications outlets, and equipment are clear from and in proper relation to these items.
 - c. Recessing and concealing communications materials in CMU walls, concrete construction and precast construction.
 - d. In every telecommunication room with either active or passive equipment the Contractor shall monitor the work of all trades to assure that the space and clearance requirements of code are met.
3. The Electrical Contractor shall furnish and install certain power distribution and supply panels, wiring, conductors, conduits, junction boxes, and terminations for the supply of 120VAC power to security system components as indicated on the Drawings. It shall be the responsibility of the Security Contractor to provide the Electrical Contractor with complete information regarding 120VAC requirements, including 120VAC distribution and supply panels and terminations, and information for all security conduit and backboxes. The Security Contractor shall provide UPS units.

4. The Security Contractor shall furnish and install all Division 28 low voltage security systems interconnecting electrical conductors. The Security Contractor shall clearly mark all conductors and shall make all connections in accordance with the NEC.
- D. The Security Contractor shall provide and test all fiber optic cable within and between buildings and all perimeter site equipment locations. Refer to Communications Backbone Cabling Section for all fiber optic cabling requirements. All terminations, connectors and fiber optic transmitters, receivers, and transceivers required as part of Division 28 security systems shall be provided by the Security Contractor.
- E. The Security Contractor shall obtain all required Permits and Inspections required by the local AHJ. The Security Contractor is responsible for all associated cost and scheduling of the inspections. The Security Contractor shall coordinate all permitting with the Owner.

2.06 MATERIAL AND WORKMANSHIP

- A. General: Unless otherwise specifically provided in this Contract, all equipment, material and articles to be incorporated in the Work shall be new and of the most suitable grade for the purpose intended. Unless stated otherwise, reference to any equipment, material, article or patented process in the Specifications, by trade name, make or catalog number shall be regarded as establishing a standard of performance and quality.
- B. Submitted Materials: The Security Contractor shall furnish to the Owner for his acceptance the name of the manufacturer, the model number and other identifying data and information respecting the performance, capacity, nature and rating of the electrical, mechanical and other equipment that the Security Contractor contemplates incorporating in the Work. When required by this Contract or when called for by the Owner, the Security Contractor shall furnish to the Owner for his acceptance full information concerning the material or articles that he contemplates incorporating in the Work.

2.07 SUBMITTALS

- A. General: Comply with requirements of this section and all other relative sections.
- B. Operation, Maintenance, and Service Manuals: Prior to final acceptance, complete sets of operation, maintenance and service manuals shall be submitted for systems and equipment provided under this contract. The manuals shall be compiled, assembled and indexed, in an easily identifiable hardcover form. The manuals shall be submitted to the Owner prior to final acceptance testing. The manuals shall include the following:
 1. Table of contents;
 2. An index for quick references to name, mailing address, website, and telephone number for service for each item of equipment or system;

3. Complete operating instructions;
 4. Complete maintenance instructions, wiring diagrams, and troubleshooting instructions;
 5. System service instructions for work which manufacturers recommend user service;
 6. Complete parts lists for each major item of equipment and/or for each system;
 7. Complete collection of manufacturers' product and catalog literature for equipment and systems installed under this contract;
 8. Manufacturers' warranties;
 9. Operating characteristics, performance data, ratings, and manufacturers' specifications for each item of equipment or system;
 10. Where practical, internal wiring diagrams and schematics; and
 11. Software User Documentation including operating instructions, programming instructions, technical documentation and maintenance procedures to permit making changes to system configuration, time changes, etc.
- C. As-Built Drawings: Security Contractor shall provide, and keep up-to-date, a complete record set of red-lined drawings, which shall be corrected and shall show every change from the original Specifications and Contract Drawings through final acceptance. This shall not be construed as authorization for the Security Contractor to make changes in the Work without proper approvals.
- D. Additional Submittals: In addition to the submittals described above, other required submittals described in this and other Sections of the Specification must be presented and approved prior to final acceptance.

2.08 TRAINING

- A. The Security Contractor shall provide a minimum of (8) hours of on-site training. The Security Contractor shall provide all training materials (users manuals, licenses, site specific information, maintenance and operations manuals, etc.). The Security Contractor shall coordinate and schedule the training well in advance.

PART 3 - - PRODUCTS

3.01 GENERAL REQUIREMENTS

- A. General: Except as otherwise specified, equipment and materials furnished shall be new, first grade, standard, current products of the manufacturer and shall be suitable for the systems being installed and the intent of the design.
- B. Damaged Products: Any material, device or equipment damaged prior to or during installation and before acceptance of the completed system by the Owner shall be replaced, unless repairs can be made that are acceptable to the Owner. Any such replacement or repairs, including repairs to the finish, shall be made at no cost to the Owner.

- C. Protection of Materials: Equipment and materials shall be properly stored, adequately protected and carefully handled to prevent damage before and during installation. Equipment and materials shall be handled, stored and protected in accordance with the manufacturers' recommendations. Equipment provided with a factory finish shall be maintained free of dust, dirt and foreign matter. Dents, marred finishes and other damage shall be repaired to its original condition or shall be replaced, at no additional cost to the Owner. The Contractor shall protect the Owner's and General Contractor's equipment and materials, as well as the Security Contractor's tools and materials, against theft and vandalism.

3.02 SECURITY SYSTEMS

- A. Provide a complete and integrated system including the following subsystems:
 - 1. Access Control, Alarm Monitoring
 - 2. Video Surveillance System
 - 3. Low Voltage Power Distribution System

3.03 INTEGRATED SYSTEM FUNCTIONAL REQUIREMENTS

- A. Open Architecture: To the extent possible, all systems provided as part of the Work shall utilize open architecture. Systems proposed in the Bids that are based on open architecture will be looked upon more favorably than proprietary-based systems. Full integration of all security systems is required.
- B. Access Control and Alarm Monitoring System: Provide a Security Management and Control System (SMCS) as defined in Section 28 13 00 - ACCESS CONTROL. The SMCS shall include, but not be limited to, intelligent distributed processors, gate controls, power supplies, intrusion detection sensors, monitoring workstations, and network equipment as described herein.
- C. Video Surveillance System: Provide a Network Video Recorders (NVR) and Video Management System (VMS) Software as defined in Section 28 23 00 - VIDEO SURVEILLANCE. The Video Surveillance System shall include, but not be limited to, video cameras, lenses, housings, mounts, monitors, VMS workstations, video encoders, video decoders, quad splitters, video recorders, power supplies, and network equipment as described herein.
- D. Security Monitoring Stations: Provide equipment at remote security monitoring stations with components and accessories to control, process, integrate, and annunciate alarm signals from the security system from locations shown on the Drawings. Provide all hardware, software, licenses and installation as defined in the drawings and specifications

- E. Low Voltage Power Distribution System: Provide a complete low voltage power distribution system for access control devices and cameras as specified herein. Provide uninterruptible power supply (UPS) units and power distribution as specified herein and other sections of the Specifications.

3.04 INTEGRATED SYSTEM PERFORMANCE REQUIREMENTS

- A. General: All systems specified herein shall operate as a complete integrated system. The Security Management and Control System shall provide centralized control. All other systems shall interface into this system.
- B. Camera Coverage: Certain video cameras shall automatically cue-up upon activation of card readers, door position switches, intercoms, and/or other alarm inputs indicated on the Drawings. Pan-tilt-zoom cameras shall have alarm pre-set and home positions programmed into the system as indicated on the Drawings and approved by the Owner.

3.05 SYSTEM COMPONENT DESIGN AND PERFORMANCE CRITERIA

- A. General: Within the context of the overall system performance previously described, the system components shall be designed to operate as described herein.
- B. Modularity: Provide components designed for modular increase or decrease of system capability by installation or removal of plug-in modules. System components shall be designed to facilitate modular subassembly and part replacement.
- C. Reliability: Provide only new, unused components free from flaws or imperfections, which are in current manufacturing production. Components shall be manufactured to meet all the requirements specified herein and shall be free from characteristics or defects that affect the appearance or which might affect the serviceability or render the equipment unsuitable for the intended purpose. The workmanship shall be of superior quality. The MTBF for any sensor component shall not be less than five-thousand (5000) hours. Provide components designed for continuous operation. Electronic components of the system shall be of the solid-state type, mounted on printed circuit boards conforming to UL 796. Boards shall be plug-in, quick-disconnect type. Circuitry shall not be so densely placed as to impede maintenance. Power-dissipating components shall incorporate safety margins of not less than 25% with respect to dissipation ratings, maximum voltages, and current-carrying capacity. Light duty relays and similar switching devices shall be solid-state type or hermetically sealed electro-mechanical type.
- D. Maintainability: The components shall be capable of being maintained using commercially available standard tools and equipment. Components shall be so arranged and assembled that they are readily accessible to maintenance personnel without compromising the defeat resistance of the various security subsystems.

3.06 TAMPER PROVISIONS

- A. General: Enclosures, cabinets, panels, housings, boxes, and fittings of every description having hinged doors or covers larger than 11"x11" that contain circuits of the security system and its power supplies, shall be provided with cover-operated corrosion-resistant tamper switches, arranged to initiate an alarm signal when the door is moved as little as one-quarter (1/4) inch from its normally closed position.
- B. Mounting: Tamper switches shall be mechanically mounted to maximize the defeat time when enclosure covers are opened and removed.
- C. Deactivation: The minimum amount of time required to depress or defeat the tamper switch after opening or removing the cover shall be greater than one (1) second.
- D. Accessibility: Enclosure and tamper switch shall function in such a manner as to not allow direct line of sight to any internal components or the tampering of the switch or circuit wiring. Tamper switches shall be:
 - 1. Inaccessible until the switch is activated;
 - 2. Have mounting hardware concealed so that location of the switch cannot be observed from the exterior of the enclosure;
 - 3. Be under electrical supervision at all times, irrespective of the protection mode in which the circuit is operating;
 - 4. Shall be spring-loaded and held in the closed position by the door protected; and
 - 5. Shall be wired so that they break the circuit when the door is disturbed.
- E. Security Screws: Covers to non-hinged enclosures smaller than 12"x12" that must be opened on a regular basis to make normal maintenance adjustments to the system and to service the power supplies shall be provided with security screws instead of tamper switches.
- F. Junction Boxes: Covers of pull boxes and junction boxes installed during the initial installation of the system need not be provided with tamper switches. Exposed junction boxes in areas accessible to the public shall be avoided. Install junction boxes and other enclosures above ceilings or other locations that are not easily accessible. Where junction boxes must be installed in accessible areas, provide tamper resistant security screws.

3.07 SYSTEM ALARM ANNUNCIATION

- A. General: System alarm annunciation shall include tamper, fail-safe, line fault, and power loss.
- B. Tamper: Enclosures, cabinets, housings, boxes, raceways, and fittings having hinged doors or removable covers larger than 11"x11" that contain circuits of the intrusion detection system and its power supplies shall be provided with tamper switches.

- C. Fail-Safe Alarms: Provide a fail-safe capability in all critical elements of the system. Fail-safe is defined as the capability to monitor for proper system functions and to report an alarm when a failure is detected in any critical system function. This shall include, but not be limited to, the capability to monitor communication link integrity and to provide self-test. When diminished functional capabilities are detected, the system shall provide annunciation of the fault. Fail-safe alarms shall be annunciated to clearly distinguish them from other types of alarms.
- D. Fail-Safe Locking: All locking shall be fail-safe to the extent that such locking is required by appropriate and pertinent life-safety and building codes. Fail-safe locking shall be understood to mean that upon failure, locks shall fail in the "unlocked" and "unsecured" position. All required locking shall be interconnected into the building's fire alarm system and, upon activation of the fire alarm system, shall immediately "unlock" to permit emergency egress from the building. The Security Contractor shall coordinate all interface requirements with the fire alarm system installer. The Security Contractor shall furnish and install the necessary interface relays and interconnecting wiring, conduits, and mounting hardware, etc. to effect this operation.
- E. Line Fault: As a minimum, fault isolation at the systems level shall have the same geographic resolution as provided for intrusion detection. The communication links of the security system shall have an active mode for line fault detection. Active mode is defined as that in which some type of signal is continuously sent across the link, resulting in simple link breaks being readily detected. The system shall be either a static system or a dynamic system. In a static system, the "no-alarm" condition shall always be represented by the same signal, which shall be different than the signal originally transmitted. The dynamic system shall represent "no-alarm" with a signal that continually changes with time.
- F. Power Loss: Provide the capability to detect when any critical component of the system experiences loss of primary power and/or is switched over to either emergency power or uninterruptible power and to declare an alarm. The alarm shall be annunciated to clearly identify the component experiencing the power loss.

3.08 MATERIALS NOT LISTED

- A. Furnish all necessary hardware, materials, and supporting equipment required to place in full operation the specified major subsystems. Some supporting equipment, materials, and hardware may not be described in the Contract Drawings and may not be identified herein, but are required for full and complete operation in accordance with the intent of the design and these Specifications.

3.09 LIKE ITEMS

- A. Where two or more items of equipment performing the same function are required, they shall be exact duplicates produced by one manufacturer. All equipment provided shall be complete, new and free of any defects.

3.10 WARRANTY

- A. **Written Guarantee:** The Security Contractor shall, as a condition precedent to the final payment, execute a written guarantee (warranty) to the Owner certifying that all the contract requirements have been completed in accordance with the final Specifications and Contract Drawings and warranting all materials and equipment furnished by the Security Contractor under this contract to remain in satisfactory operating condition (ordinary wear and tear, abuse and causes beyond his control for this Work excepted) for a period of one (1) year from the date of final acceptance or beneficial occupancy, whichever is later. All defects or damages due to faulty materials or workmanship shall be repaired or replaced without delay to the Owner's satisfaction at the Security Contractor's expense.
- B. **Software:** Contractor shall honor all factory service agreements provided as part of any software installed as part of the Work. In the event any software does not include a minimum one year factory service agreement, the Contractor shall obtain one year service agreements at his own expense. During the warranty period, the Contractor shall load all software or firmware updates and patches for any software provided as part of the Work as soon as available from the manufacturer.
- C. **Response:** Repair or maintenance services during the warranty period shall be available via telephone within one (1) hour and on site within four (4) hours upon a call by the Owner. Contractor shall agree to these criteria in writing prior to the start of the mandatory one-year warranty period.
- D. **Change to System:** In no case shall the integrated system/security equipment warranties be voided where user-programmable programming changes are performed by the trained Owner's appointed system programming representative, to include redefining system input/output points, operation characteristics, time delays, and report formats to the Owner's site-particular requirements.

PART 4 - - EXECUTION

4.01 EQUIPMENT INSTALLATION

- A. The Security Contractor shall install the security system in accordance with the standards for safety, UL-1037 and UL-1076, and the appropriate installation manual for each equipment type. Security Contractor does not have to be a UL-listed contractor. Components within the system shall be configured with appropriate "service points" so that system trouble can be pinpointed readily.

4.02 CABLE/WIRES INSTALLATION

- A. Security Contractor-provided cable/wire runs and conduit shall be installed in accordance with applicable electrical Work standards, national and local codes, and NFPA 70, as well as manufacturers' specifications of installed equipment.

4.03 INTERIOR WIRING AND CONDUIT FOR SECURITY SYSTEMS

- A. General: In addition to requirements specified in other sections of the Specification, as a minimum, the Security Contractor's Work for Division 28 shall conform as described herein. Conflicts, if any, shall be promptly brought to the attention of the Owner.
- B. Codes: All Work shall be in accordance with the National Electrical Code (NEC) and local governing codes and laws.
- C. Interior Conduit Type: All interior conduits shall be electro-metallic tubing (EMT), except where otherwise noted. Exceptions for different conduit types for various classes of construction shall be requested of the Owner as appropriate, such as for cast-in-place concrete, buried conduit, exposed conduit, and placement in cable ducts. Minimum size of conduit shall be three-quarter (3/4) inch, with the exception of "drop" conduits at door locations which may be one-half (1/2) inch. Connections shall be thread-less type fittings or couplings. Fastenings and supports for conduit shall be in accordance with the national and local codes. All security systems conductors shall be installed in conduit. Exceptions shall require the Owner's written approval.
- D. Conduit Routing: Conduits shall have runs installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Changes in direction of runs shall be made with symmetrical bends or cast metal fittings. All conduits shall be affixed or supported at intervals and using prescribed methods and devices in accordance with governing codes. No run of conduit between outlets or fittings shall contain more than four quarter bends (360 degrees). Bends shall be made such that the conduit will not be injured and that the interval diameter will not be effectively reduced. All connections shall be tight so as not to create intermittent loss of ground protection. All cut ends entering into fittings shall be reamed smooth or have a bushing inserted to prevent damage to wire insulation. Conduit and raceway runs shall be kept at least six (6) inches from non-insulated flues, steam pipes or any pipe containing a hot gas or liquid. So far as practical, avoid traps and dips in conduit runs that might collect moisture. Strict attention shall be given to all conduits containing fiber optic cabling, if any, to ensure that manufacturer's recommended conduit bend radii limitations/restrictions are followed.

- E. Connectors: Where conduits connect to sheet steel enclosures, they shall be fastened with two (2) locknuts where insulating bushings are used. Bushings shall be installed on ends of all conduits where they terminate in pull boxes, outlet boxes, cabinets, etc. and shall be of the insulating type and shall be securely fastened with locknuts on each side. Crushed or deformed conduits shall not be installed. Bushings shall not be used as locknuts. Open ends shall be sealed around security conductors to be liquid tight using an approved air-drying sealer after capping ends with insulated bushings.
- F. Special Conditions: Conduits crossing expansion joints in concrete slabs shall be provided with suitable expansion fittings, or other suitable means, to compensate for building expansion and contraction. Conduits traversing hazardous areas shall use the penetrations and fittings shown on the drawings and provided under other sections of the contract. The Security Contractor shall seal the fittings subsequent to verifying the integrity of the contained conductors. Conduit shall not block ceiling or equipment access doors. Where conduit or raceway is passed through walls, floors, ceilings or roofs, annular space shall be sealed or patched. Openings in fire walls and all corridor walls shall be sealed with mineral wool or an approved silicone sealant. No conduit shall be fastened to other pipe or conduit or installed so as to prevent the ready removal of other pipe or conduit for repairs. Conduit, panels, devices and boxes shall be secured by means of shields in concrete, machine screws on metal surfaces and wood screws on wood construction material.
- G. Shop Drawings: Security Contractor shall submit conduit and wire layout drawings showing circuit numbers, types of conductors, size of conduits, and wiring/conduit routes for approval by the Owner prior to the initiation of Work. Security Contractor shall coordinate shop drawings of the security systems conduit routing with fire wall construction, mechanical duct work, structural components, fire protection, and plumbing.
- H. Continuous Wiring: All conductors shall be run continuously between sensors, processors, junction boxes, terminal strips or panels, and other approved devices. Splices between such locations are not permitted. Necessary junctions shall be made using screw-type terminal blocks, or in accordance with manufacturer's requirements for equipment connections.

4.04 ELECTRICAL POWER

- A. High Voltage (120VAC) Power:
 - 1. Division 26 shall provide 120VAC power where indicated on the Drawings. Security Contractor is solely responsible for coordinating UPS requirements for security devices. The UPS primary power feed shall be connected to the emergency generator system's electrical distribution system by the Electrical Contractor. At all other security device locations requiring 120VAC primary power, power shall be fed from emergency generator power system circuits, provided by the Electrical Contractor.

- B. The Electrical Contractor shall furnish and install wiring, conductors, conduit, and terminations for the supply of 120VAC power to security system components where located on the Drawings and specified herein. It shall be the responsibility of the Security Contractor to furnish and install all low voltage conductors and associated conduit and to make all final connections. The Security Contractor shall provide the Electrical Contractor with complete information regarding 120VAC power requirements.
- C. Batteries: Provide backup by dedicated batteries for all equipment in remotely located system elements such as NVR, network switches, power supplies, remote processor units, relay cabinets, control units or individual sensors that are not provided with UPS power with battery backup (if any). Batteries shall be sized to provide continuous stand-by operation for a minimum of four (4) hours without recharge or replacement, unless connected to the building's emergency power distribution system, in which case the batteries shall be sized to provide full operating power for twenty (20) minutes.

4.05 ADJUSTMENT/ALIGNMENT/SYNCHRONIZATION/CLEANING

- A. Subsequent to installation, the Security Contractor shall clean each system component of dust, dirt, grease or oil incurred or accrued from other project activities and prepare for system activation by manufacturer's recommended procedures for adjustment, alignment, or synchronization. Each component shall be prepared in accordance with the appropriate provisions of the component's installation, operations, and maintenance manuals.

4.06 CLEAN, SQUARE INSTALLATION

- A. All equipment shall be clean and free of paint and other defacing materials. All installations shall be square and plumb. The Security Contractor shall take care that other trades do not deface equipment and do not move equipment out of square and plumb. If equipment is moved, the Security Contractor shall re-install the equipment to be square and plumb.

4.07 TESTS AND VERIFICATIONS

- A. General: The Security Contractor shall verify that all requirements of this specification are met. Upon completion of the installation, procedures shall be performed to calibrate and test all equipment, verify data transmission media operation, place the integrated system in service, and test the integrated system. A report shall be submitted describing results of functional tests, diagnostics, and calibrations, including written certification that the installed complete system has been calibrated, and tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure. Verification shall be through a combination of analyses, inspections, demonstrations and tests, as described below.

4.08 FINAL CLEANING

- A. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. All stains, soil marks, dirt and other forms of defacement resulting from the Security Contractor's Work shall be removed or repaired. The Security Contractor shall remove from the Project site all tools, appliances, debris, and packing materials; remove all paint stains, blemishes, and foreign materials; clean all mechanical and electrical equipment. Use only materials and cleaning agents recommended by the material supplier. The Security Contractor shall assume responsibility for damage caused by his cleaning operations.

B. END OF SECTION 28 05 00

SECTION 28 23 00 - VIDEO SURVEILLANCE

PART 1 - - GENERAL

1.01 GENERAL

- A. This Section includes provisions a complete Video Surveillance System (VSS) including the following:
 - 1. Video Management System Software (VMS), including software that acts as a virtual matrix switcher, workstations, network video recording, controls, and cameras.
 - 2. Network Video Recorders (NVR)
 - 3. LCD Display Monitors.
 - 4. Compact Dome Cameras.
 - 5. Pan, Tilt and Zoom Cameras.
 - 6. Signal Transmission System.

1.02 RELATED DOCUMENTS

- A. Drawings and Special Provisions of the Contract, including General and Supplementary Conditions, apply to this Section.
- B. Division 1 - All Sections;
- C. Division 28 " Common Work Results for Electronic Safety and Security
- D. Division 28 " Conductors and Cables for Electronic Safety and Security
- E. Division 28 - Access Control System
- F. Attendant Contract Drawings.

1.03 SYSTEM DESCRIPTION

- A. General: The contractor will provide a new Video Surveillance System (VSS) including color, solid-state cameras and lenses within unitized domes, mounts, camera housings, virtual matrix switcher, monitors, network video recorders (NVR), software, licenses, power supplies, equipment enclosures, raceway, cabling, and other attendant components and hardware described in this Section.

- B. Power and Wiring: Furnish and install all VSS system control wiring, copper, fiber optic and power cables, and associated mounting hardware. Provide localized camera power supplies in designated equipment rooms and associated low-voltage wiring for connection to cameras. 120 VAC uninterruptible power input feeds to camera power supplies, network video storage devices, VMS workstations, console monitors, fiber optic transmission equipment, and related equipment will be provided by the Contractor. Conduit from all cameras to associated equipment rooms will be provided. It will be the responsibility of the Security Contractor to coordinate all 120 VAC power and conduit requirements with the Division 26 Electrical Contractor for quantities and circuit capacities as required.
- C. Camera/Monitor Linked Displays: Cameras that are directly associated with an event, such as the movement through a controlled door, will be linked at the monitoring station via the Access Control/Alarm Monitoring System. The scenes will be geographically oriented, such as west, center and east.

1.04 SUBMITTALS

- A. Product data for all specified products.
- B. Shop Drawings: Contractor will indicate exact camera positions on shop drawings and in coordination with other trades and with no obstructions.

PART 2 - - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Network Video Recorder (NVR):
 - 1. Network Video Recorder (NVR)
 - a. Rasilient
 - b. Dell
 - c. HP
 - d. Milestone
 - e. Panasonic
 - f. Pelco
 - g. Or approved equal
 - 2. Video Management Software (VMS)
 - a. Milestone
 - b. Genetec
 - c. Panasonic

- d. Pelco
- e. Or approved equal

2.02 NETWORK VIDEO RECORDERS

- A. General: The Security Contractor shall provide and install a Network Video Recorders, and all required mounting hardware, software and licenses required.

1. Acceptable Manufacturer:

- a. Iomnis Surveillance 391 Series -16TB (minimum) - Match Existing
- b. Milestone Software and Licenses - Match Existing

B. NVR Characteristics:

1. General: The Security Contractor shall provide and install a Network Video Recorders, and all required mounting hardware, software and licenses required.
2. The NVR shall be capable of connecting to up to 128 network cameras without extra license fees and their images can be recorded simultaneously.
3. The NVR shall be equipped with 16TB of storage (minimum) each.
4. Additional iSCSI / RAID storage capable.
5. RAID 5/6 capabilities.
6. Rack mount capable.
7. The NVR shall be the equipment with an embedded real-time operating system and shall not be based on a Microsoft Windows OS. The OS must reside completely in the hardware and not be installed on the hard disk drives. Installed disk drives must be dedicated to recording videos.
8. The NVR shall support H.264, H.265, MPEG-4 and JPEG multi format.
9. The NVR shall have a built-in network interface (10BASE-T / 100BASE-TX / 1000BASE-T) for camera recording and client access.
10. NRV shall have sufficient hard drives to record and store 30 days at 1080P Resolution, 1 fps continuous recording on all cameras and 10 fps continuous on alarm detection plus 25% (minimum) spare capacity.
11. The contractor is responsible for completing the video storage calculations to ensure that 30 days of storage is provided at the parameters stated above. If additional hard drive (TB) storage is required to meet the minimum criteria, the contractor is responsible to provide additional NVR units or additional hard drive (TB) capacity.
12. The Contractor shall provide five (5) years of license support.

2.03 VIDEO MANAGEMENT SYSTEM SOFTWARE (VMS)

- A. General: The Video Management Software will be a digital, networked, computer-controlled, virtual matrix switching system designed for VSS applications. All equipment and materials will be standard components that are regularly manufactured and utilized in the manufacturer's system. The Video Management Software will be an enterprise level software package that offers a complete video surveillance solution scalable from one to hundreds of cameras where each camera may be added on a unit-by-unit basis.
- B. VMS Software License: The Security Contractor shall provide the VMS software and ten (10) operator licenses. Coordinate software and license deployment with the Owner prior to installation.
- C. VMS Software and Camera Licenses: There shall be a one-time cost associated for software and camera licenses for five (5) years.
- D. VMS Software: The VMS software package will be fully capable of running on a non-proprietary PC workstation to provide the installation, administration and operation of video surveillance systems using M-JPEG, MPEG-4 and H.264 video compression technology via local networks. The VMS will search and locate all transmitting and receiving stations (video servers), video monitors, and recording devices installed on the network, including their IP addresses and additional properties, in a window tree display and then allow a system administrator to construct a functional graphical user interface (GUI) via the software. Video from any of the installed devices may then be displayed by dragging the device symbol into a workspace software monitor window. Video may be displayed in full screen mode or 2x2 and 3x3 multi-screen formats. The software will functionally operate as a virtual network video matrix system capable of switching video to software monitors within the VMS window on the workstation and/or displaying the pictures on analog VSS monitors when compatible manufacturer recommended decoders are installed on the network. The software will support H.264 based hardware products as well as network video recording.
- E. Characteristics: The VMS will:
 - 1. Support IP network connectivity, including LAN, WAN, VPN, Internet, and wireless (WiFi and Cellular) technologies. The VMS will support IP Multicast (UDP) and Unicast (TCP or UDP) video streaming as well as Multi-unicast;
 - 2. Treat the network as a digital virtual matrix system by allowing cameras to be connected to monitors using a drag and drop function;
 - 3. Display several simultaneous live picture connections from cameras in the network;
 - 4. Provide a configuration tool that allows the creation of site maps with camera locations and monitor placement, and allow interactive operation, including PTZ control;
 - 5. Programming of alarm-triggered events and automatic video recording to network connected video recorders;
 - 6. Retrieve and play back the archived video from remote hard drives, Compact Flash memory of compatible devices or from network video recorders;

7. Be capable of displaying H.264 video streams in real-time at bandwidths ranging from 10 Kbits/sec to 4 Mbits/sec, ranging from 1 ips to 30 ips with resolution ranging from QCIF to 4CIF;
8. Independently set each camera's bit rate, frame rate and resolution. Altering these settings will not affect the recording or display settings of other cameras;
9. Require a user name and password that determines the level of authorization as being a user or administrator of the VMS;
10. Provide control of PTZ cameras via VMS workstations;
11. Allow remote video servers to be controllable from VMS workstations;
12. Have an instant replay function that allows video recorded on network devices equipped with local disk storage to be reviewed and, if desired, backed up to network video storage device. The instant replay function will be controlled via a slider bar and "VCR like" buttons;
13. Have advanced search functions, including:
 - a. Date/time;
 - b. Camera;
 - c. Recording type;
 - d. Storage location; and
 - e. Alarm/event type.
14. Provide a function that automatically creates a logbook during every session in which all events and actions are recorded. The logbook may be viewed, searched using various filters, and the results saved as a text file;
15. Provide a camera overview function that shows at a glance thumbnail previews of available cameras in the system that may be dragged into a workspace software monitor;
16. Allow programming of camera sequences where pictures will be displayed one after the other on the display monitor. Sequences may also be programmed where cameras are switched on selected monitors as a synchronized group;
17. Provide site map-based operation using a site map editor that allows the user to create and view facility drawings on which camera icons and other system devices have been placed. Icons of all the devices, such as video servers and monitors, and functions such as alarm inputs or relay outputs that are available in the system may be placed within the site maps. Selection of an icon on a site map will allow devices to be chosen, cameras to be displayed and controlled on monitors, and other site maps to be selected or linked from one site map to another. Existing drawings may also be imported into the software as bitmaps and then the icons added to the imported drawing. Graphic files with formats of .png, .bmp, .xbm, .xpm, .pnm, .jpeg, and .jpg may be imported into the system for use as site maps; and
18. Be able to save snapshots as .jpg format images to the hard drive of a computer running a Windows-based operating system with the appropriate application software to view and print .jpg format files. These .jpg images may then be printed, converted to another format or placed into a word processing document.

F. Alarm Handling Capability:

1. The VMS will handle alarms generated from the Access Control/Alarm Monitoring System for automatic call up of fixed and PTZ cameras. PTZ cameras will automatically move to pre-programmed positions to view the associated area.
- G. Video Workstations: The networked video workstations will be used to view live streaming and recorded video, as well as access the VMS. Video workstations will have the following minimum features:
1. Intel Core i7-860 or greater processor.
 2. Minimum 16 GB of RAM.
 3. Network adapter 10/1000 Mbit Ethernet.
 4. Standard sound card.
 5. Minimum 2 TB storage capacity.
 6. Windows 10 Professional Workstation.
 7. DirectX 10.0 or better driver.
 8. Graphic card: supporting 1280 x 800 pixels or more (1920 x 1080 pixels recommended). 256MB or more of VRAM. Dual monitor support.
 9. Two (2) 24" minimum LCD / LED desktop monitors.
- H. Contractor shall coordinate the workstations specifications with the Owner prior to installation.
- I. Contractor is to provide a workstation that meets or exceeds the current Owners specifications.
- J. Video Management Software (VMS): The Work will include the following provisions:
1. Storage: The video storage array system will provide 30 days minimum online storage and retrieval of video through the use of a rack mounted, Network Video Recorder Hard Drives. The system will be capable of completely restoring recorded data in the event of network failure. Network Video Recorder will be located in designated equipment rooms and sized as required herein with capacities up to 48 TB (16 TB minimum) of video storage.
 2. Format: Video Storage Array devices will store H.264 format compressed.
 3. Demonstration: The Contractor will demonstrate to the Owner video streams in images per second (ips) at various resolution settings (in common intermediate format or CIF) for the Owner to select separate settings for each individual camera. Recording rates will be programmed by the Contractor for a minimum of near real-time for alarms and transactions processed by the access control system and for time-lapse recording of all other events. Motion detection will be implemented during configuration of the video storage system for cameras selected by the Owner. All other cameras will be recorded continuously.
 4. VMS Software: The VMS software will provide full access and functionality for all video. However, limited operation will also be available via a web browser.

5. Recording: The VMS system will provide both a Continuous Record mode for uninterrupted recording and an Event Recording mode that starts recording only during an alarm condition received from the VMS. Alarms from a remote video server may be generated by external alarm contact inputs, motion detection, object tracking, video loss, or low video contrast of the input camera video. Both pre-alarm and post alarm recording shall be available. System shall be sized sufficiently for a minimum of 10 fps at 4CIF for alarms and 5 fps at 4CIF continuously for all cameras in system
6. Features: The VMS system will have the following features:
 - a. Display a replay page that provides time and date filters for selecting recordings for replay. Replay of recordings will be controlled using simple PLAY, STOP, PAUSE, FAST FORWARD, REWIND, STEP FORWARD, and STEP REWIND buttons. Recordings may be saved as single image JPEG snapshots or as MPEG format video clips.
 - b. Provide a schedule function so that recording times may be programmed for specific times of the day and week.
 - c. Provide a Status Page that displays information regarding the current status of the VMS system, including remaining hard drive capacity and any active H.264 recordings, in addition to a list of all recording tasks.
 - d. Provide direct access to recorded video by allowing password protected access from any location using a web browser or VMS software.
 - e. Provide a network time server function to synchronize the video server and recordings.
 - f. Provide watermarking for authentication of recorded video.
7. Restoration: The VMS system will automatically restore data lost on the network recorder due to network failure. Once network operation is restored, the VMS software will retrieve video that has been stored on the local hard drives or Compact Flash memory of the video servers and copy the data into the gaps of lost data on the network recorder. Current video will still continue to be recorded while the VMS system is replenishing the network video recording gaps.

2.04 MONITORS

- A. LCD Display: Provide flat screen LCD or LED displays suitable for VSS applications sized as indicated herein and where shown on the Contract Drawings. Provide all necessary console and/or rack mounting kits as requested by the Owner. Flat panel displays will have the following characteristics:
 1. Minimum of two (2) 24" screen size for desktop applications (per workstation)
 2. Minimum of 55" for wall mounted applications
 3. Minimum 740 TV lines resolution.
 4. 1024 x 768 pixels (minimum).
 5. Desktop, wall mount or rack mount capability.
 6. Can accept PAL and NTSC signal formats.
 7. Y/C (S-video) input and two CVBS (composite video) with active loop through inputs.
 8. Thin film transfer (TFT) LCD panel.
 9. Rated life of 50,000 hours.

10. Front panel and on-screen display controls with power, standby and sequence mode LEDs.
11. Operating temperature range of 0-degrees C to 40-degrees C at 90% max humidity.

2.05 COMPACT DOME CAMERAS

- A. General: The integrated fixed or pan tilt zoom (PTZ) VSS cameras will be a domed camera system containing a -1/3 inch or smaller image format, NTSC, color CCD camera with an auto iris fixed, varifocal or zoom lens, as indicated on the Video Surveillance Schedule found in the Drawings. For PTZ domes, provide a high speed pan/tilt and an integral, intelligent receiver/driver. The unit will be capable of being disconnected and replaced with another unit while still under power (hot swappable) for ease of maintenance.
 1. Axis Communications
 2. Arecont Vision
 3. Panasonic
 4. Pelco
 5. Or approved equal
- B. Mounts and Backboxes:
 1. Wall Mount Brackets
 2. Ceiling (Recessed) Mount Support
 3. Corner Mount Adapter
- C. All cameras shall have a three (3) year warranty (minimum).
- D. Equipment:
 1. Altronix R2416600UL
 2. Or approved equal

2.06 CABLING

- A. See Specification Section 27 15 00 Communications Horizontal Cabling.
- B. Provide low voltage cable from equipment rooms to camera locations as follows:
 1. Category 6A for all Ethernet POE connections
 2. Fiber Optic Cabling where defined in the drawings and in compliance with the specifications.
 3. Power Cabling. Minimum size 18 AWG
 4. Contractor is responsible to verify all wiring sizes, voltage drop calculations and conduit fill ratios. Contractor shall bring any discrepancies to the attention of the Owner.

PART 3 - - EXECUTION

3.01 INSTALLATION

- A. Exact mounting locations of cameras and types of housings and mounts will be approved by the owner prior to installation of devices, hardware or conduit. Contractor will review locations, fields-of-view, scene illumination, and appearances of equipment with the owner as part of the approval process.

3.02 ELECTRICAL POWER

- A. Video equipment located in consoles and distribution areas will be powered by 120VAC via uninterruptible power supply. Cameras will be powered from camera power supplies provided by the Contractor and connected to uninterruptible power.
- B. All electrical power shall be equipped with surge protection. All surge protection devices shall be grounded per the National Electrical Code (NEC).

3.03 MOUNTING

- A. For rack mounted equipment, such as power supplies, monitors, network video recorders, etc., provide all necessary rack mounts and mounting equipment for equipment layouts shown on the Drawings.
- B. For enclosure mounted equipment, such as power supplies, access control equipment, RFID equipment, etc., provide all necessary mounting hardware for equipment mounting, i.e. Back plates, stand-off's, grounding bar, etc.

3.04 LIGHT LEVELS

- A. It is the sole responsibility of the Contractor to produce quality pictures on monitors with sufficient brightness at all times of day or night. If required, Contractor will perform lighting level calculations to determine whether low light sensitive cameras are required. Particular attention will be given to nighttime conditions for exterior cameras. If low light cameras are required, Contractor will submit to the owner for approval and provide as part of this Work at no additional cost to the owner.

3.05 CONFIGURATION AND PROGRAMMING

- A. All new and existing head end configuration and programming will be performed by the contractor.
- B. Any programming of new devices such as NVR devices will be performed by the contractor.

- C. VMS Programming for handling alarms generated by Access Control / Alarm Monitoring System will be performed by the Contractor (coordinate with Owner).

3.06 TESTING

- A. The Contractor shall field-prove that the scene of view provided at each camera location will provide coverage to the Owner's satisfaction and acceptance. Contractor shall demonstrate camera cue-up on associated events from Access Control System as required.

B. END OF SECTION 28 23 00

SECTION 28 34 01 - FUEL LEAK-MONITORING SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. The installation of a complete fuel monitoring system complete with all modules, sensors, alarms, and other related items.
2. Trenching and backfill for fuel system control and monitoring cables. (If required)
3. Wiring and conduit from tanks to monitoring console (located indoors as shown in the Drawings), and to electric motor control center for pump interlocks.
4. Mounting and wiring alarm horn/lights.
5. Programming of monitoring system.
6. City training.

B. Related Sections:

1. Section 23 13 23 œAboveground Fuel Storage Tank System .
2. Section 23 12 17 œDiesel Fuel Dispensing System .
3. Other project documents as required per contract.

1.02 REFERENCES

- A. NFPA 70 - National Electric Code (2011), with State of California amendments.**
- B. International Code Council:**
1. International Fire Code (2011) with State of California and City of Santa Barbara amendments.
- C. NFPA 30 - Flammable and Combustible Liquids Code (2012)**

1.03 SUBMITTALS

- A. Submit shop drawings:** Indicate dimensions, service connections, accessories, controls, electrical data, and wiring diagrams.
- B. Product Data:** Indicate dimensions, service connections, accessories, controls, electrical nameplate data, and wiring diagrams.
- C. Manufacturer's Installation Instructions:** Indicate assembly, wiring and installation instructions.

- D. Operation and Maintenance Data. Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

1.04 QUALITY ASSURANCE

- A. General. Materials, apparatus, and equipment required for the work described in this Section shall be constructed and installed in accordance with the references cited above; and with the requirements of the local and state building and plumbing codes and ordinances, all legally constituted public authorities having jurisdiction, including State and county laws, rules and regulations, and City of Santa Barbara ordinances.

1.05 WARRANTY

- A. Provide one-year warranty.

1.06 MAINTENANCE SERVICE

- A. Furnish service and maintenance of system for one year from Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Provide a Veeder-Root Model TLS-350 PLUS console, with integral printer, and data communication via Ethernet and POTS. No other product is acceptable without prior written approval by the Owner.

2.02 FUEL LEAK DETECTION SYSTEM:

- A. General. Provide an electronic programmable hydrocarbon liquid leak detection and monitoring system. System shall be capable of monitoring up to eight fuel storage tanks and dispensers. The leak detection system and its components shall be listed by UL, and by the National Work Group on Leak Detection Evaluations (NWGLDE). The monitoring panel shall incorporate FM approved, Intrinsically Safe Barriers to allow the installation of sensors in Class 1, Division 1, Group B, C, and D as defined by the National Electrical Code (NEC). System shall function with a maximum sensor cable length of 1000 feet.

- B. Type. Leak detection monitoring console shall be microprocessor-based for continuous monitoring capability. The system shall incorporate a self-diagnostic feature actuated by panel-mounted test button, to check all circuitry for proper operation. The monitoring system shall be remotely accessible to, and controllable by, a PC equipped with Veeder Root Remote Control Software and a telephone modem or Ethernet card.
- C. Compatibility. All probes, sensors and other components that may be wetted by fuel products shall be compatible with diesel fuel, including ULS, B5 and B20 blends.
- D. The monitoring console shall automatically reconcile produce delivery volumes with volumes dispensed, and generate monthly reconciliation reports.
- E. Equip the monitoring console with software for performing continuous statistical leak detection (CSLD).
- F. The leak monitoring panel will be located indoors in a ventilated equipment room, as indicated in console drawings. The leak-monitoring panel shall be installed in a NEMA 1 enclosure, with lockable hinged-face panel. The panel face shall have a viewing window allowing full vision of all panel controls and indicators, and be capable of monitoring various sensors and devices, as follows.
 - 1. Storage tank product level probes (4 each).
 - 2. Volume of diesel products dispensed, as indicated by dispenser pulser outputs.
 - 3. Liquid leak sensors in the following locations:
 - a. Dispenser sump (1 location),
 - b. AST secondary containment (1 location),
 - 4. Monitoring fluid reservoir levels in the following locations.
 - a. Dispenser sump (N/A),
 - b. Piping transition sumps (N/A).
 - 5. Overfill alarm relay.
 - 6. Overfill alarm horns and lights with NEMA 7 reset switch, installed at fill stations (Refer to the Drawings for location).
- G. Monitor features: Provide the following capabilities in the monitor panel:
 - 1. Paper printer to produce following reports:
 - a. Inventory reports
 - b. Low inventory alert.
 - 2. In-tank leak test capabilities:
 - a. 0.1 GPH automatic tank gauging.
 - b. 0.1 GPH volumetric tank tightness testing.
 - c. Selectable 0.2 or 0.1 GPH test rates.
 - d. Programmable test schedules.

- e. Leak test validity checks.
 - f. Pass, fail, short or invalid indicators.
3. Alarm Capabilities: Alarm set points shall be programmable. Provide the capability to give alarm for the following conditions:
- a. Liquid leak
 - b. Overfill.
 - c. High product level.
 - d. Theft.
 - e. High water.
 - f. Low inventory.
 - g. External input.
- H. Sensors and Probes. Provide the following sensors and probes as part of the system:
- 1. Magnetostrictive probe for inventory measurement and in-tank continuous statistical leak detection (CLSD), one for each storage tank (1 probe total), with 0.1 GPH minimum leak detection capability. Furnish 5-each Veeder Root Mag Plus with CLSD, Form No. 843690-107 (probe length as appropriate).
 - 2. Dispenser containment sump sensor “ shall detect any liquid leak and not discriminate between hydrocarbon and water. Provide Veeder-Root Non-discriminating Solid State Dispenser Pan Sensor, Form No. 794380-321, (1 sensor in total).
 - 3. Interstitial Tank Sensors, one sensor installed in each AST tank wall. Furnish Veeder Root Interstitial Sensor for use in Steel Tanks, Form No. 794390-420 (1 sensor in total).
 - 4. Provide sensor cabling, tank and pipe adapters, and other miscellaneous fittings as may be required to install a complete, operable system. All devices and installation practices shall comply with NEC Article 514 (2011 edition).
 - 5. Sensor Cable: All cable to be minimum #14 AWG copper, shielded, and as otherwise specified in the manufacturer™s installation manual.
 - 6. Conduit: All conduit shall be rigid PVC-coated galvanized steel, size as indicated on the Drawings, with Class 1, Division 1, Group D seals and junction boxes in hazardous areas.
- I. Required monitoring console components: Provide the following components or subsystems as part of the monitoring console.
- 1. Four-input level probe interface module, Form No. 329356-002.
 - 2. Type B Interface Module (P/N 329950-001) for solid-state liquid sensors (2-modules).
 - 3. Interstitial/Liquid Sensor Interface Module (P/N 329358-001) for AST secondary containment sensors (1-module).
 - 4. Eight-input dispenser pulser interface module (1-module).
 - 5. SiteFax interface module with telephone modem (for automatically generating reports via telefax), Form No. 330149-002.
 - 6. RS-485/232 Dual Port Communications Module, Form No. 330586-001.
 - 7. Ethernet-TCP/IP Communications Card for the TLS-350 Series Consoles.
 - 8. Remote Control™ Windows-based PC control software.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install to NFPA 30 (2012) and NEC (2011) Article 514.
- C. Installation of Control and Monitoring Conduit and Wire:
 - 1. All conduit shall be installed a minimum of 24 inches deep in PVC-coated rigid galvanized steel conduit.

3.02 MANUFACTURER'S FIELD SERVICES

- A. Provide initial factory authorized start-up and two site visits during first year of operation, including routine servicing and checklist.
 - 1. Submit two copies of start-up report under cover letter of local authorized factory service agent certifying equipment is installed per manufacturer's instructions, and that equipment is operating properly, and all programming and alarm set points are functioning to Factory Specifications.

3.03 DEMONSTRATION AND TRAINING

- A. Provide 4 hours of onsite training of Owner™s personnel in operation, trouble shooting, and programming of fuel monitoring system. Provide outline of training given, dates and personnel in attendance.

END OF SECTION 28 34 01

SECTION 32 17 23 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Painted markings applied to asphalt paving.
 - 2. Painted markings applied to concrete surfaces.

1.03 ACTION SUBMITTALS

- A. Product Data: Include technical data and tested physical and performance properties.
 - 1. Pavement-marking paint, alkyd.
 - 2. Pavement-marking paint, acrylic.
 - 3. Glass beads.

1.04 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Conco Paints.
 - 2. Diamond Vogel Paints.
 - 3. Dow Chemical Company (The).
 - 4. Dunn-Edwards Corporation.
 - 5. Ennis-Flint.
 - 6. Insl-X Products; Benjamin Moore & Co.

- 7. PPG Paints.
- 8. Sherwin-Williams Company (The).

- B. Source Limitations: Obtain pavement-marking paints from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

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

2.03 PAVEMENT-MARKING PAINT

- A. Pavement-Marking Paint, Alkyd: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, ; colors complying with FS TT-P-1952F.

- 1. Color: As indicated.

- B. Pavement-Marking Paint, Acrylic: Acrylic, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952F, Type II, with drying time of less than 45 minutes.

- 1. Color: As indicated.

- C. Glass Beads: AASHTO M 247, Type 1 or FS TT-B-1325D, Type 1.

- 1. Roundness: Minimum 75 percent true spheres by weight.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that pavement-marking substrate is dry and in suitable condition to begin pavement marking in accordance with manufacturer's written instructions.
- B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.02 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow asphalt paving or concrete surfaces to age for a minimum of 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.

- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
 - 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to asphalt paving or concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
 - 2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal..

3.03 PROTECTING AND CLEANING

- A. Protect pavement markings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 32 17 23

SECTION 32 17 26 - TACTILE WARNING SURFACING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Fiber reinforced plastic detectable warning tiles, flush-set.

1.03 ACTION SUBMITTALS

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

1.04 PROJECT CONDITIONS

- A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

PART 2 - PRODUCTS

2.01 TACTILE WARNING SURFACING, GENERAL

- A. Accessibility Requirements: Comply with applicable provisions in ICC A117.1 for tactile warning surfaces.
 - 1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.
- B. Source Limitations: Obtain each type of tactile warning surfacing from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.02 DETECTABLE WARNING TILES

- A. Flush-Set Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Access Products, Inc.
 - b. ACO Polymer Products, Inc.
 - c. ADA Solutions, Inc.
 - d. Advanced Surface Systems, LLC.
 - e. Armorcast Products Co.
 - f. Detectable Warning Systems, Inc.
 - g. Detectile, Inc.
 - h. Engineered Plastics, Inc.; Armor-Tile.
 - 2. Material: Molded glass- and carbon-fiber-reinforced polyester.
 - 3. Color: Safety yellow.
 - 4. Shapes and Sizes:
 - a. Rectangular panel, 36 by 48 inches .
 - 5. Dome Spacing and Configuration: 2.35-inch spacing, in square pattern.
 - 6. Mounting:
 - a. Permanently embedded detectable warning tile wet-set into freshly poured concrete.
 - b. Detectable warning tile set into formed recess in concrete and adhered with mortar.
 - c. Replaceable detectable warning tile wet-set into freshly poured concrete and surface-fastened to permanently embedded anchors.

2.03 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of tactile warning surfaces, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Furnish Type 304 stainless-steel fasteners for exterior use.
 - 2. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant heads, colored to match tile.
- B. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF TACTILE WARNING SURFACING

- A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.
- B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

3.03 INSTALLATION OF DETECTABLE WARNING TILES

- A. Cast-in-Place Detectable Warning Tiles:
 - 1. Concrete Paving Installation: Comply with installation requirements in Section 32 13 13 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of tile.
 - 2. Set each detectable warning tile accurately and firmly in place and completely seat tile back and embedments in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
 - 3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch from flush.
 - 4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.
 - 5. Clean tiles using methods recommended in writing by manufacturer.
- B. Removable Cast-in-Place Detectable Warning Tiles:
 - 1. Concrete Paving Installation: Comply with installation requirements in Section 32 13 13 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of removable tile.

2. Set each detectable warning tile accurately and firmly in place with embedding anchors and fasteners attached, and firmly seat tile back in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch from flush.
4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.
5. Clean tiles using methods recommended in writing by manufacturer.

C. Surface-Applied Detectable Warning Tiles:

1. Lay out detectable warning tiles as indicated and mark concrete pavement.
2. Prepare existing paving surface by grinding and cleaning as recommended by manufacturer.
 - a. Cut perimeter kerf in existing concrete pavement to receive metal tile flange.
3. Apply adhesive to back of tiles in amounts and pattern recommended by manufacturer, and set tiles in place. Firmly seat tiles in adhesive bed, eliminating air pockets and establishing full adhesion to pavement. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
4. Install anchor devices through face of tiles and into pavement using anchors located as recommended by manufacturer. Set heads of anchors flush with top surface of mat.
5. Mask perimeter of tiles and adjacent concrete, and apply sealant in continuous bead around perimeter of tile installation.
6. Remove masking, adhesive, excess sealant, and soil from exposed surfaces of detectable warning tiles and surrounding concrete pavement using cleaning agents recommended in writing by manufacturer.
7. Protect installed tiles from traffic until adhesive has set.

3.04 CLEANING AND PROTECTION

- A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.
- B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 32 17 26

SECTION 32 31 19 - DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Decorative metallic-coated-steel tubular picket fences, prefabricated.
 - 2. Horizontal-slide gates.
 - 3. Swing gates.
 - 4. Gate operators, including controls.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For gates. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include diagrams for power, signal, and control wiring.
- C. Samples: For each fence material and for each color specified.
 - 1. Provide Samples 12 inches in length for linear materials.
 - 2. Provide Samples 12 inches square for sheet or plate materials.

1.05 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For decorative metallic-coated-steel tubular picket fences, including finish, indicating compliance with referenced standard and other specified requirements.

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For gate operators to include in maintenance manuals.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

2.02 DECORATIVE METALLIC-COATED-STEEL TUBULAR PICKET FENCES, PREFABRICATED

- A. Decorative Metallic-Coated-Steel Tubular Picket Fences: Comply with ASTM F 2408 for light industrial (commercial) application (class) unless otherwise indicated.

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Ameristar Aegis II, Genesis design, 2-rail style or approved equal.

- B. Posts: Unless noted otherwise on drawings, provide posts based on the following criteria.

- 1. End and Corner Posts: Square tubes 3 by 3 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
 - 2. Posts at Horizontal-Slide Gate Openings Wider Than 12 Feet: Square steel tubing 4 by 4 inches with 3/16-inch wall thickness, hot-dip galvanized.
 - 3. Guide Posts for Class 1 Horizontal-Slide Gates: Square steel tubing 4 by 4 inches with 3/16-inch wall thickness, hot-dip galvanized; installed adjacent to gate post to permit gate to slide in space between.

- C. Post Caps: Aluminum castings finished to match fencing.

- D. Rails: Square tubes.

- 1. Size: 1-3/4 by 1-3/4 inches.
 - 2. Metal and Thickness: 0.079-inch nominal-thickness, metallic-coated steel sheet or 0.075-inch nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.

- E. Pickets: Square tubes.
 - 1. Extend pickets beyond top rail as indicated and terminate with galvanized-steel Quad-Flair finial cap.
 - 2. Picket Spacing: 4 inches on center, maximum.
- F. Fasteners: Manufacturer's standard tamperproof, corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers.
- G. Metallic-Coated Steel Sheet Infill: Galvanized-steel sheet or aluminum-zinc, alloy-coated perforated steel sheet in locations and sizes indicated on Drawings.
- H. Interior surface of tubes formed from uncoated steel sheet shall be hot-dip zinc coated same as exterior.
- I. Galvanizing: For components indicated to be galvanized and for which galvanized coating is not specified in ASTM F 2408, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
- J. Finish: Organic coating complying with requirements in ASTM F 2408 Powder coating. Base coat minimum thickness of 2 mils; topcoat minimum thickness of 2 mils.

2.03 HORIZONTAL-ROLLING GATE SYSTEM

- A. Decorative Metallic-Coated-Steel Tubular Picket Rolling Gate: Comply with ASTM F 2408 for light industrial (commercial) application (class) unless otherwise indicated.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Ameristar PastPort II, Industrial Ornamental design series, Genesis, 2-rail style; or approved equal.
- B. Gate Configuration: Single leaf, as indicated on Drawings.
- C. Gate Frame Height: As indicated.
- D. Gate Opening Width: As indicated.
- E. Automated vehicular gates shall comply with ASTM F 2200, Class II.
- F. Galvanized-Steel Frames and Bracing: Fabricate members from square tubing.
 - 1. Frame Members: Square tubes 2 by 2 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
 - a. Bottom Rail: 2 by 4 inches.

2. Bracing Members: Square tubes 2 by 2 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
- G. Frame Corner Construction:
1. Welded frame with panels assembled with bolted or riveted corner fittings.
- H. Additional Rails: Provide as indicated, complying with requirements for fence rails.
- I. Infill: Comply with requirements for adjacent fence.
- J. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.
- K. Hardware: Latches permitting operation from both sides of gate, roller assemblies and stops fabricated from galvanized steel. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.
- L. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.
- M. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.

2.04 SWING GATES

- A. Gate Configuration: As indicated.
- B. Gate Frame Height: As indicated.
- C. Gate Opening Width: As indicated.
- D. Automated vehicular gates shall comply with ASTM F 2200, Class IV.
- E. Galvanized-Steel Frames and Bracing: Fabricate members from square tubing. Unless noted otherwise on drawings, provide framing based on the following criteria.
1. Frame Members: Square tubes 2 by 2 inches (51 by 51 mm) formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.
 2. Bracing Members: Square tubes 2 by 2 inches (51 by 51 mm) formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.

- F. Frame Corner Construction: Welded frame with panels assembled with bolted or riveted corner fittings.
- G. Additional Rails: Provide as indicated, complying with requirements for fence rails.
- H. Infill: Comply with requirements for adjacent fence.
- I. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.
- J. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet (1.52 m) wide. Provide cane bolts for pairs of gates. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.
- K. Exit Hardware: BHMA A156.3, Grade 1, Type 1 (rim exit device), with push pad actuating bar, suitable for exterior use.
 - 1. Mounting Channel: Bent-plate channel formed from 1/8-inch- (3.2-mm-) thick, steel plate. Channel spans gate frame. Exit device is mounted on channel web, recessed between flanges, with flanges extending 1/8 inch beyond push pad surface.
- L. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 1/2-inch-diameter, round steel bars, hot-dip galvanized after fabrication. Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in closed position.
- M. Finish exposed welds to comply with NOMMA Guideline 1, Finish #3 - partially dressed weld with splatter removed.
- N. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
- O. Metallic-Coated-Steel Finish: High-performance coating.

2.05 GATE OPERATORS

- A. Gate Operators:
 - 1. Basis-of-Design Products: Subject to compliance with requirements, provide products listed below, or approved equal.
 - a. Swing Gate Operator: CSW200UL by Liftmaster.
 - b. Slide Gate Operator: SL3000UL by Liftmaster.

- B. Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.
 - 1. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
 - 2. Provide operator with UL approval.
 - 3. Provide electronic components with built-in troubleshooting diagnostic feature.
 - 4. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.
- C. Comply with NFPA 70.
- D. UL Standard: Manufacturer and label gate operators to comply with UL 325.
- E. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators on gates that must provide emergency access.
 - 1. Gate operator controls to be integrated with Fire Department's required Knox Box gate controls.
- F. Motor Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, within installed environment, with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1 and the following:
 - 1. Voltage: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
 - 2. Horsepower: Not less than 1 HP.
 - 3. Enclosure: Manufacturer's standard, lockable, weather resistant cover.
 - 4. Service Factor: 1.15 for totally enclosed motors.
 - 5. Phase: Polyphase as required.
 - 6. Duty: Continuous duty ambient temperature of 105 deg F.
- G. Gate Operators: Concrete base mounted and as follows:
 - 1. Mechanical Slide Gate Operators:
 - a. Duty: Heavy duty, commercial/industrial.
 - b. Gate Speed: Minimum 11 inches per second.
 - c. Operating Type: Roller chain, with manual release.
 - d. Drive Type: Enclosed worm gear reducers, roller-chain drive.
 - e. UL 325, UL991, ASTM F2200, and CAS C22.2 No. 247 compliant.
- H. Remote Controls: Electric controls separated from gate and motor and drive mechanism, with NEMA ICS 6 enclosure for surface mounting, and with space for additional optional equipment. Provide the following remote-control device(s):

1. Control Station: Keyed, three-position switch with open, stop, and close function; located remotely from gate. Provide two keys per station.
2. Radio Control: Digital system consisting of code-compatible universal receiver , with remote antenna with coaxial cable and mounting brackets designed to operate gates. Provide one programmable transmitter(s) with multiple-code capability permitting validating or voiding of not less than 1000 codes per channel configured for the following functions:
 - a. Transmitters: Single button operated, with open and close function.
- I. Vehicle Loop Detector: System includes automatic closing timer with adjustable time delay , timer cutoff switch, and loop detector designed to open and close gate, hold gate open until traffic clears, and reverse gate. System includes electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. System includes number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement, as recommended in writing by detection system manufacturer for function indicated, at location shown on Drawings.
- J. Vehicle Presence Detector: System includes automatic closing timer with adjustable time delay and presence detector designed to hold gate open until traffic clears and reverse gate. System includes retroreflective detector with adjustable detection zone pattern and sensitivity, designed to detect the presence or transit of a vehicle in gate pathway when infrared beam in zone pattern is interrupted, and to emit a signal activating the gate operator.
- K. Obstruction Detection Devices: Provide motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:
 1. Action: Reverse gate in both opening and closing cycles, and hold until clear of obstruction.
 2. Action: Stop gate in opening cycle and reverse gate in closing cycle, and hold until clear of obstruction.
 3. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
 4. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows.
 - a. Along entire gate leaf leading edge.
 - b. Along entire gate leaf trailing edge.
 5. Photoelectric/Infrared Sensor System: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.
- L. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions.
- M. Emergency Release Mechanism: Quick-disconnect release of operator drive system of the following type, permitting manual operation if operator fails. Design system so control-circuit power is disconnected during manual operation.

1. Type: Mechanical device, key, or crank-activated release.

N. Operating Features:

1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features. Provide unit that is isolated from voltage spikes and surges.
2. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
3. Automatic Closing Timer: With adjustable time delay before closing and timer cutoff switch.
4. Open Override Circuit: Designed to override closing commands.
5. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
6. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.
7. Clock Timer: 24-hour programmable for regular events.

O. Accessories:

1. Battery Backup System: Battery-powered drive and access-control system, independent of primary drive system:
 - a. Fail-Safe: Gate opens and remains open until power is restored.
 - b. Fail-Secure: Gate cycles on battery power, then fail-safe when battery is discharged.
2. Instructional, Safety, and Warning Labels and Signs: According to UL 325.
3. Equipment Bases/Pads:
 - a. Base: Manufacturer's standard operator base for specified model. Installed per manufacturer's written instructions.
 - b. Pad: Cast in place concrete pad as indicated on Drawings.

2.06 STEEL AND IRON

- A. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Bars (Pickets): Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
- C. Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- D. Metallic Coated Steel Sheet:
 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 50, with G90 coating.

2. Aluminum-Zinc, Alloy-Coated Steel Sheet: ASTM A 792/A 792M, structural quality, Grade 50, with AZ60 coating.

E. Castings: Either gray or malleable iron unless otherwise indicated.

1. Gray Iron: ASTM A 48/A 48M, Class 30.
2. Malleable Iron: ASTM A 47/A 47M.

2.07 MISCELLANEOUS MATERIALS

- A. Concrete: Normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size or dry, packaged, normal-weight concrete mix complying with ASTM C 387/C 387M mixed with potable water according to manufacturer's written instructions.
- B. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M and specifically recommended by manufacturer for exterior applications.

2.08 GROUNDING MATERIALS

- A. Grounding Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 1. Material above Finished Grade: Aluminum.
 2. Material on or below Finished Grade: Copper.
 3. Bonding Jumpers: Braided copper tape, 1 inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- B. Grounding Connectors and Grounding Rods: Comply with UL 467.
 1. Connectors for Below-Grade Use: Exothermic-welded type.
 2. Grounding Rods: Copper-clad steel.
 - a. Size: 5/8 by 96 inches.

2.09 METALLIC-COATED-STEEL FINISHES

- A. Galvanized Finish: Clean welds, mechanical connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.
- B. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a zinc-phosphate conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

- C. Powder Coating: Immediately after cleaning and pretreating, apply two-coat finish consisting of zinc-rich epoxy prime coat and TGIC polyester topcoat, with a minimum dry film thickness of 2 mils for topcoat. Comply with coating manufacturer's written instructions to achieve a minimum total dry film thickness of 4 mils.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.
 - 2. Comply with surface finish testing requirements in ASTM F 2408 except change corrosion-resistance requirement to 3000 hours without failure.
- D. High-Performance Coating: Apply epoxy primer, polyurethane intermediate coat, and polyurethane topcoat to prepared surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
 - 1. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.
- B. Do not begin installation before final grading is completed unless otherwise permitted by Owner's Representative.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Mark locations of fence lines, gates, and terminal posts. Indicate locations of utilities, underground structures, benchmarks, and property monuments.
 - 1. Construction layout and field engineering are specified in Section 01 73 00 "Execution."

3.03 DECORATIVE FENCE INSTALLATION

- A. Install fences according to manufacturer's written instructions.
- B. Install fences by setting posts as indicated and fastening infill panels to posts. Peen threads of bolts after assembly to prevent removal.

C. Post Setting:

1. Space posts uniformly at spacing indicated on Drawings.
2. Posts Set in Concrete Footings: Set posts in concrete fill into firm, undisturbed soil.
 - a. Excavation: Drill or hand-excavate holes for posts. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet.
 - b. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete.
 - c. Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
 - d. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
3. Mechanically Anchored Posts: Set posts with mechanical anchors into substrate indicated at indicated spacing.
 - a. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with mechanical devices.

3.04 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.05 GATE OPERATOR INSTALLATION

- A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.
- B. Excavation for Concrete Bases: Hand-excavate holes for bases in firm, undisturbed soil to dimensions and depths and at locations as required by gate operator component manufacturer's written instructions and as indicated.
- C. Concrete Bases: Cast-in-place or precast concrete, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.
- D. Vehicle Loop Detector System: Cut grooves in pavement and bury and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.

- E. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

3.06 GROUNDING AND BONDING

- A. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:
 - 1. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.
 - a. Gates and Other Fence Openings: Ground fence on each side of opening.
 - 1) Bond metal gates to gate posts.
 - 2) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.
- B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.
- C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.
- D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.
- E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
- F. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- G. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

3.07 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Automatic Gate Operators: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, alarms, and limit switches.
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Test and adjust controls, alarms, and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Lubricate hardware, gate operators, and other moving parts.

3.08 DEMONSTRATION

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

END OF SECTION 32 31 19



Environmental Consulting Services
Asbestos • Mold • Lead • Property Assessment

June 15, 2022

Mr. Frank Reynoso, Facilities Specialist
Santa Barbara Metropolitan Transit District
550 Olive Street
Santa Barbara, CA 93101
freynoso@sbmtd.gov

Subject: Asbestos & Lead Survey Report
Santa Barbara MTD Terminal 2
5353 Overpass Road
Goleta, CA 93111
FCG Job Code: SBMTD-02

Dear Mr. Reynoso:

FCG Environmental (FCG) performed a hazardous materials survey at the above-referenced property, which included asbestos bulk sampling and lead-based paint testing. The investigation was performed by FCG personnel on May 24, 2022, under the supervision of Alan Forbess, a CA Certified Asbestos Consultant (CAC No. 94-1549) and CA Lead Inspector/Assessor (LRC No. 505/504). This report documents the results of our survey, which included materials that may be disturbed as part of future site renovations.

1.0 Background Information / Scope of Project

Background: The subject site is the Santa Barbara Metropolitan Transit District's Goleta terminal (Terminal 2) which is scheduled for renovations and possible future demolition activities. FCG was asked to conduct a survey of building materials in order to identify hazardous materials issues prior to disturbance in accordance with federal, state and local regulations.

Scope of Project: The following services were conducted in order to define asbestos and lead concerns at the subject site:

- A visual inspection of representative materials at each structure was conducted to identify suspect asbestos and lead containing materials.
- Bulk samples were collected from suspect asbestos containing materials for submittal to a qualified laboratory for analysis. All bulk samples were analyzed by SGS Analytical, a state-certified laboratory located in Carson, CA. All samples were analyzed by polarized light microscopy (PLM), to determine asbestos fiber concentrations in bulk building material samples. PLM is applicable for the analysis of building survey submissions and other bulk materials.
- Screening for lead-based paint was conducted using an X-Ray Fluorescence (XRF) paint analyzer to screen representative surfaces and materials suspected of being coated with lead-based paint.

FCG Environmental
June 15, 2022

Asbestos & Lead Survey Report
Santa Barbara MTD Terminal 2
5353 Overpass Rd. Goleta, CA 93111

- All field observations, laboratory analytical data, XRF readings and other findings have been evaluated, with this written report summarizing our findings and providing recommendations as necessary.

2.0 Asbestos Survey

Site Description: The subject site is a large storage and maintenance yard with an office building on the east side facing the street. A metal shop (Butler Building) used for vehicle repairs featuring three repair bays with roll-up doors is attached to the west side of the office building. A small addition on the south side of the shop features a flat roof with composite sheet roofing. Two large open structures (metal awnings) are located on the main portion of the site. Each structure features metal support framing and columns with metal roof decks. Both storage structures are covered by composite roofing materials (rolled roofing). A drive-through bus wash structure constructed of concrete block is located on the south side of the property with a covered awning on the east side over the pump and compressor equipment associated with the wash station.

Suspect Materials: After a visual inspection was completed, the following suspect asbestos materials were noted:

Office Building & Bus Maintenance Shop

- Office Exterior stucco – throughout office building
- Office Roofing layers (composite shingle) – east pitched sections of building
- Maint. Shop Roof coating (white) – upper metal roof over shop
- Maint. Shop Roof caulking (white over black) – upper metal roof at base of air vents & penetrations
- South addition flat roof layers (hot mop with stones)
- South addition flat roof mastics at corners, penetrations & drip edge flashing
- South addition flat roof - HVAC duct seam (white) at lower seam
- South addition flat roof - Exterior grey caulking at louvered vents & HVAC penetrations
- Beige vibration gaskets – bus garage
- Exterior metal siding bolt washer (grey) – west side at all bolts
- Exterior stucco eave – throughout
- Exterior caulking (black) – at wood panels below windows behind wood trim

Interior office areas

- Brown 12" vinyl floor tile with yellow mastic
- Cove base mastics (lower walls)
- 2' x 2' suspended ceiling – acoustic tiles
- Drywall with joint compound – throughout interior

Bus Wash Building and Equipment Awning

- Equipment lid gaskets (brown)
- Awning roofing layers (composite sheet with insulation) – over metal deck
- Awning roofing mastic (black) – under topside of drip edge flashing
- *Note: Bus Wash structure was too tall to inspect the exterior roofing, but appears to have a metal roof deck covered by composite sheet roofing (similar to storage awnings).*

FCG Environmental
June 15, 2022

Asbestos & Lead Survey Report
Santa Barbara MTD Terminal 2
5353 Overpass Rd. Goleta, CA 93111

South & North Storage Canopies (open sides with metal framing)

- Roofing mastics (black) – under topside of drip edge flashing
- Roofing layers (composite sheet over insulation) – throughout over metal deck

Bulk Sampling: FCG collected 46 bulk samples from suspect asbestos containing materials from the subject site area of proposed renovations. Samples were forwarded to SGS Forensic Analytical for analysis by Polarized Light Microscopy (PLM) using EPA Method 600/R-93-116, Visual Area Estimation. Table 1 below provides a summary of those materials which tested positive for asbestos based on laboratory analytical data from collected samples. Please refer to the Attachments for a complete copy of the laboratory analytical results.

Table 1: List of Identified Asbestos Containing Materials

Sample ID	Asbestos Containing Material	Location	% Asbestos (Chrysotile)	Category & Friability
10	Black Caulking on Roof Penetrations	Bus Maintenance Shop Upper Metal Roof around 10" Flue Pipes (~2 sf)	White Caulking = ND Black Caulking = 2%	Category I, Non-Friable Material
13	Black Mastic on Roof penetrations	Bus Maintenance Shop South Flat Roof at Corners, Penetrations & Drip Edge Flashing Corners (~20 sf)	Black Mastic = 2% Stones = ND Black Tars & Felts = ND	Category I, Non-friable Material
14	Silver Paint (Over White Seam Mastic)	Bus Maintenance Shop South Flat Roof at Lower Seam (~10 sf)	White Mastic = ND Silver Paint = 2%	Category I, Non-friable Material
39	Roofing Mastics	Bus Washing Area Equipment Canopy Under Drip Edge Flashing (~80 lf)	Black Mastic = 2% Stones = ND Black Tars & Felts = ND	Category I, Non-friable Material
40	Roofing Mastics	South Storage Canopy Under Drip Edge Flashing (Throughout perimeter)	Black Mastic = 3%	Category I, Non-friable Material
45	Roofing Mastics	North Storage Canopy Under Drip Edge Flashing (Throughout perimeter)	Black Mastic = 3%	Category I, Non-friable Materials
PACM	Roofing Mastics	Bus Wash Building (Roofing not sampled due to height of building)	Presumed ACM	Category I, Non-friable Materials
*PACM = Presumed Asbestos Containing Material (not sampled) Please refer to the attached laboratory analytical report and bulk sample logs for additional information.				

Materials Testing Negative: The following materials were sampled and tested negative for asbestos:

Office Building & Bus Maintenance Shop

- Exterior stucco – throughout office
- Roofing layers (composite shingle) – east pitched section
- Roof coating (white) – upper metal roof

FCG Environmental
June 15, 2022

Asbestos & Lead Survey Report
Santa Barbara MTD Terminal 2
5353 Overpass Rd. Goleta, CA 93111

- Roof caulking (white over black) – upper metal roof at base of air vents
- Roofing layers (hot mop with stones) – throughout south flat roof
- Exterior grey caulking – south addition flat roof at louvered vents & HVAC penetrations
- Brown 12" vinyl floor tile with yellow mastic – office interior
- Cove base *with* mastic – throughout interior
- 2' x 2' suspended acoustic ceiling tiles – office interior
- Drywall with joint compound – throughout office interior
- Beige vibration gaskets – bus garage
- Exterior metal siding bolt washer (grey) – west side at all bolts
- Exterior stucco eaves – throughout office building exterior
- Exterior caulking (black) – at wood panels below windows behind wood trim

Bus Washroom

- Equipment lid gaskets (brown)
- Roofing layers (composite sheet with insulation) – throughout over metal

South & North Bus Parking Canopies

- Roofing layers (composite sheet with insulation) – throughout over metal

Notes on Tables and Assessment Terms

- Asbestos containing material (ACM): Federal and County APCD regulations define ACM as any material or product that contains more than 1% asbestos.
- Asbestos containing construction material (ACCM): State regulations define ACCM as any material with greater than 0.1% asbestos by weight.
- Asbestos renovation: Defined by NESHAPS as the removal of more than 160 square feet or 260 linear feet of ACM. OSHA requires registration of all contractors removing more than 100 sq. ft. on any project.
- Friable ACM: any ACM that when dry can be crumbled, pulverized, or reduced to powder by normal hand pressure.
- Non-friable ACM: any ACM that **cannot** be reduced to powder by normal hand pressure.
- Category I non-friable ACM: asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products (typically pliable materials, including sealants and mastics).
- Category II non-friable ACM: any other ACM that when dry **cannot** be reduced to powder by hand pressure (typically non-pliable/cementitious materials).
- Regulated Asbestos Containing Material (RACM): any *friable* ACM that will be removed during a renovation of a regulated structure. ACM that will become friable due to the removal technique is also regulated. Note: while linoleum flooring is considered Category II ACM while managed in place, removal *always* renders it friable.
- Presumed Asbestos Containing Materials (PACM): This designation is for those materials which are normally asbestos containing but were not sampled due to access issues or potential for irreparable damage. This typically includes transite (asbestos cement) piping or sheeting, or HVAC insulation materials in walls, under floors, etc. where destructive testing is not recommended. Regulations allow asbestos inspectors to "presume" that these materials contain asbestos without laboratory data based on the inspector's experience and knowledge of building materials.
- Trace (<1%) Asbestos: Federal and local APCD regulations define an asbestos containing material (ACM) as any compound with greater than 1% asbestos. The State of California through Cal-OSHA regulation further defines an asbestos containing material as any compound which meets or exceeds a concentration of 0.1% asbestos by weight. This definition is primarily for worker and occupant protection during disturbance work. The polarized light microscopy (PLM) method does not quantify the concentration asbestos in bulk samples at levels of less than 1%.

FCG Environmental
June 15, 2022

Asbestos & Lead Survey Report
Santa Barbara MTD Terminal 2
5353 Overpass Rd. Goleta, CA 93111

Furthermore, PLM methodology will include all fibers with a similar aspect ratio (3:1) to asbestos fibers, and therefore may count non-asbestos fibers as part of the overall total. PLM analytical methods must report a "trace" amount where fibers are noted in concentrations of less than 1% of the total. Further analysis by more quantitative methods such as "Point Count" or transmission electron microscopy (TEM) are required to quantify the actual concentration of asbestos in "trace" PLM sample results.

Summary: Our survey has identified a number of Asbestos Containing Materials (ACM) at the site which will require abatement or special handling as part of future site work. Please see the Conclusions & Recommendations (Section 4.0) below for further discussion regarding the abatement and proper handling of asbestos containing materials.

3.0 Lead-Based Paint Survey

FCG was contracted to perform field testing to determine the presence of lead-based paint or lead components at the subject site. A visual inspection of the site was conducted to identify areas of suspect lead-based paint or coatings. Screening for lead was conducted in the field using XRF methodology in accordance with current state and federal regulations. All field work was conducted by a Certified Lead Inspector/Assessor. The findings of this survey will be used by contracting personnel to determine appropriate lead safe work practices prior to demolition work.

Background Information on Lead Paint Requirements: Several regulations apply to the disturbance and possible exposure to lead from paints and other coatings. Title 17 of the California Code of Regulations (CCR) applies to residences and buildings accessible to the public that were constructed prior to 1979, and schools constructed before 1993 where lead paint may exist. Cal-OSHA regulations found within Title 8 of the CCR apply to worker exposure as stated in the Lead-in-Construction Standard (8-CCR-1532.1). The EPA recently issued a final rule to address lead-based paint hazards created by renovation, repair and painting activities that disturb lead-based paint in target housing and child-occupied facilities.

The EPA's Lead Renovation, Repair and Painting (RRP) Program was passed into regulation requiring compliance with training and certification requirements per Title 40 of the Code of Federal Regulations (40 CFR Part 745). The RRP rule states that firms and individuals conducting renovations of target housing constructed before 1978 must assume that lead is present in all painted surfaces or coatings unless a written determination has been made by a Certified Inspector that the components affected by the renovation are free of paint or other surface coatings that contain lead equal to or in excess of 1.0 milligrams per square centimeter (mg/cm²) or 0.5% by weight.

Scope of Lead Testing Services: FCG's scope of services involved field testing through use of X-ray fluorescence (XRF) instrumentation, which provides instantaneous readings in the field. The XRF instrument is used because of its demonstrated abilities to accurately determine the amount of lead that is present without disturbing the painted surfaces, as well as their high speed and relatively low cost per sample. The XRF device is capable of measuring lead in both deteriorated and intact paint. See the Attachments to this report for more information on XRF sampling methodology.

Inspection Results: Per EPA and California regulations, paint or coatings are considered to be lead-based at concentrations at or above 1.0 milligram per square centimeter (mg/cm²) using

FCG Environmental
June 15, 2022

Asbestos & Lead Survey Report
Santa Barbara MTD Terminal 2
5353 Overpass Rd. Goleta, CA 93111

XRF technology. FCG tested representative remaining surfaces throughout the subject site where renovation work is planned. Calibration tests were performed at the beginning of the survey and again at the end of the survey to document that the equipment was working properly. The following is a summary of our limited survey results:

- **Painted Surfaces Testing Positive for LBP:** The following materials/surfaces were found to have lead concentrations at or above the regulatory level of 1.0 milligrams per square centimeter and are therefore considered positive for lead-based paint (LBP) per current state and federal regulations:
 - *Yellow safety stripe on metal roll-up door frames – Maintenance Shop, exterior B & D sides*
 - *Yellow safety stripe on selected columns – north canopy, exterior A side*



Photo of lead paint on roll-up door frame to Maintenance Shop. Similar yellow stripes are located on the corner support posts of the north canopy structure.

FCG Environmental
June 15, 2022

Asbestos & Lead Survey Report
Santa Barbara MTD Terminal 2
5353 Overpass Rd. Goleta, CA 93111

- **Components Testing Positive for Lead:** We have listed below those components (ceramic tiles, porcelain fixtures, etc.) that tested positive for lead above the regulated level of 1.0 mg/cm². Although not covered by the EPA's RRP rule, lead is found in the glazing compounds used to seal the surface but is not considered a "paint or coating" per EPA. Disturbance of these components may create a lead hazard which is regulated under current OSHA and CA regulations and may require special handling as part of site renovation work.
 - *Tan ceramic wall tiles – Office & Maint. Building restroom, all sides*
 - *White porcelain sink – Office & Maint. Building restroom, A side*
 - *Beige ceramic wall tiles – Office & Maint. Building janitor's closet, B side*
 - *White porcelain mop sink – Office & Maint. Building janitor's closet, B side*
 - *White porcelain sink – Office & Maint. Building break room, B side*
 - *Beige ceramic wall tiles – Office & Maint. Building men's & women's restrooms, all sides*
 - *White porcelain sink – Office & Maint. Building men's & women's restrooms, A side*

Please refer to the attached data table for a summary of all XRF field readings and the locations of lead-based materials. The A side noted on the table is the front (street side) of the subject site with the B, C and D sides continuing clockwise around the structure.

4.0 Conclusions & Recommendations

An asbestos and lead survey has been completed per the terms of our agreement to define hazardous materials issues prior to future site work. Based on our visual observations and our evaluation of analytical data, we conclude the following:

Asbestos: The following is a summary of our asbestos survey findings:

Asbestos Containing Materials (ACM): The following roofing mastics and sealant materials were found to contain greater than 1% asbestos and are regulated under current federal, state and local regulations as an *Asbestos Containing Materials (ACM)*:

- **Maintenance Shop Building & South Addition (adjacent to Office Bldg.)**
 - **Black Caulking (2%)** – Located on the upper metal shop roof at a 10-inch flue pipes, with approximately 2 sq. ft. This is a non-friable, Category I material.
 - **Black Mastic (2%)** – Located on the south addition flat roof at corners, penetrations and drip edge flashing corners, with approximately 20 sq. ft. noted. This is a non-friable, Category I material.
 - **Silver Paint (2%)** – Located on the south addition flat roof at the lower seam, with approximately 10 sq. ft. noted. This is a non-friable, Category I material.
- **Bus Wash Equipment Awning**
 - **Black Roofing Mastic (2%)** – Located on the under drip edge flashing, with approximately 80 linear feet noted. This is a non-friable, Category I material.

FCG Environmental
June 15, 2022

Asbestos & Lead Survey Report
Santa Barbara MTD Terminal 2
5353 Overpass Rd. Goleta, CA 93111

- South & North Canopy Areas
 - Black Roofing Mastic (2%) – Located throughout under the drip edge flashing, with approximately 80 linear feet. This is a non-friable, Category I material.

Presumed Asbestos Containing Materials (PACM): The following materials were not sampled due to height of the structure, making it inaccessible during our inspection. Therefore, these materials should be managed as Presumed Asbestos Containing Material (PACM) until sampling can be conducted:

- Bus Washing Structure – Roofing Materials: As we were not able to access the roof, all roofing materials should be managed as PACM until sampling can be conducted. Based on sampling results from similar roofing systems (i.e., rolled composite roofing layers, roofing mastics, etc.), we anticipate that only the mastics used around flashings and penetrations would be positive for asbestos. However testing is recommended prior to disturbance to document the asbestos content of suspect materials or PACM.

Asbestos Recommendations

- 1) All identified asbestos containing materials (ACM) that will be disturbed as part of site renovations or demolition work must be handled in accordance with applicable federal, state and local regulations. Disturbance activities should be performed only by properly trained and licensed abatement contractors using appropriate controls to prevent fiber emissions during the removal process. This may include the use of wet methods (water mist), negative pressure containment, HEPA filtration and other engineering controls to keep fibers from being dispersed in accordance with current federal, state and local regulations.
- 2) Workers performing removal should be properly protected to prevent exposure, including the use of respiratory protection with HEPA filtration, protective suits, etc. Engineering controls must be in place. Disturbance of greater than 100 sq. ft. of any ACM or ACCM must be performed by trained and licensed asbestos contractors that are currently registered with the Dept. of Occupational Safety & Health (DOSH or Cal/OSHA).
- 3) The local enforcement agency for asbestos removal projects in this area is the Santa Barbara County Air Pollution Control District (APCD). They require notification for removal of friable, regulated asbestos containing materials in quantities which exceed 160 square feet or 260 linear feet. Regardless of the quantities found, the survey report should be submitted for their review along with any required documentation or notifications for their review and approval. They also require notification for all demolition projects, including projects where a load-bearing wall is removed. Additional permit requirements may apply from the local Building Department. We recommend that you contact the local APCD and appropriate agencies directly for further information regarding permitting and regulatory requirements.
- 4) The contractor conducting abatement work is responsible for complying with local, state and federal standards for worker protection and NESHAPS regulations regarding asbestos fiber emissions. Proper removal techniques must be followed to prevent the dissemination of asbestos fibers. Notification and permitting is typically the responsibility of the abatement contractor and/or property owner. If you would like assistance

FCG Environmental
June 15, 2022

Asbestos & Lead Survey Report
Santa Barbara MTD Terminal 2
5353 Overpass Rd. Goleta, CA 93111

regarding these matters or would like the names of qualified contractors in your area, please feel free to contact FCG at (805) 646-1995.

Lead Survey Findings: FCG conducted a lead paint screening using XRF field instrumentation to identify areas of Lead-Based Paint (LBP) or lead components such as ceramic tiles with lead glazing. The following is a summary of our findings:

- **Lead-Based Paint:** The yellow safety stripes painted on the roll-up door frames of the Maintenance Shop and the corner support posts on the North Canopy structures (as listed in Section 3.0 above and the attached XRF Table) tested positive for lead above the regulatory threshold of 1.0 mg/cm² by XRF methodology. These materials meet the definition of Lead-Based Paint (LBP) and must be disturbed using Lead Safe Work Practices (see attached).
- **Lead Components:** The ceramic and porcelain components listed in Section 3.0 above and the attached XRF Table were found to contain lead above the regulatory level of 1.0 mg/cm². It should be noted that lead is typically found in the glazing materials used to seal the ceramic tile surface. According to the EPA's Frequently Asked Questions page from their website (<http://www.epa.gov/lead/pubs/rrp-faq.pdf>), ceramic and porcelain glazing is neither a surface coating nor a painted surface. Therefore, renovations that disturb porcelain or ceramic glaze are not subject to the EPA's RRP Rule. However, disturbance or damage to components with high levels of lead may result in the generation of a lead hazard due to the potential for lead dust to be generated and are regulated under OSHA and other rules related to lead exposure to workers and lead contamination of surfaces.

Lead Recommendations

- All disturbance of LBP, including paint preparation work (sanding, scraping, etc.) must be conducted in accordance with applicable State and Federal regulations and industry standards for lead. We recommend that all paint preparation and disturbance work be performed by properly trained personnel using Lead Safe Work Practices (see attached), including dust reduction methods or containment as necessary to prevent generation of a lead hazard. Proper controls and lead safe work practices must be used to avoid the generation of lead dust emissions which may contaminate the site and pose a possible health risk to occupants, unprotected workers or the general public. This will include appropriate containment, wet methods and use of hand scraping or similar methods that will minimize the generation of airborne dust emissions and potential lead hazards.
- All employees involved in paint preparation or lead disturbance work must be properly trained in **Lead Safe Work Practices**, which must be implemented as part of this project. A general summary of **Lead Safe Work Practices** is provided in the attachments to this report. These practices shall be used by contracting personnel for the successful completion of this project. Please refer to the attachments for additional information and summary of recommended work practices.
- All workers disturbing lead paint must be RRP trained, with an on-site Lead Supervisor with California Department of Public Health (CDPH) certification preferred. All workers must wear appropriate personal protective equipment (PPE), including protective suits,

FCG Environmental
June 15, 2022

Asbestos & Lead Survey Report
Santa Barbara MTD Terminal 2
5353 Overpass Rd. Goleta, CA 93111

respirators with HEPA filtration, eye protection and other controls, including the use of impermeable drop sheets, wet methods and related controls.

- Lead waste materials should be properly contained and transported for off-site disposal at a permitted facility. Lead paint chips and similar lead waste is typically hazardous waste and must be properly manifested and disposed at a Class I landfill. If necessary, waste characterization testing should be conducted to ensure proper handling and disposal.
- If the lead containing porcelain and ceramic tiles will be disturbed and damage is inevitable, the removal should be conducted by lead trained workers using appropriate dust controls and lead safe work practices. If components can be removed intact without damage, the removal work may be conducted by normal contracting personnel.
- Many of the painted surfaces showed *detectable* levels of lead at concentrations below the regulated threshold of 1.0 mg/cm². These surfaces are not regulated as lead-based paint (LBP), but may include worker protection requirements per OSHA regulations found in Title 29 of the Code of Federal Regulations and Title 8 of the California Code of Regulations. It is the employer's responsibility to document worker exposure to lead per OSHA regulations and conduct negative exposure monitoring as necessary.

General Limitations:

- All surveys are by nature limited as it is not possible to sample ALL materials found within in specific property or building. As our survey was limited to representative suspect materials within readily accessible areas only, there is potential that suspect materials previously unidentified could be discovered during site renovation work. This could include hidden materials located under existing surfaces, inaccessible locations or in other areas not within the scope of this investigation. If suspect materials are found during site work, the area should be isolated and any suspect materials tested to confirm or deny the presence of asbestos, lead or other hazards.

FCG Environmental
June 15, 2022

Asbestos & Lead Survey Report
Santa Barbara MTD Terminal 2
5353 Overpass Rd. Goleta, CA 93111

Limitations Statement

The data compiled and evaluated as part of this assessment was limited and may not represent all conditions at the subject site. Asbestos was widely used until the late 1970's in thousands of building materials (i.e. joint compound, wallboard, thermal system insulation (TSI), acoustical ceiling, roofing material, etc.), making it difficult to locate all areas of ACM usage. This assessment reflects the data collected from the specific locations tested to identify Asbestos Containing Materials (ACM) in those locations and may not be all encompassing. There is always potential for asbestos containing materials to be missed due to problems with accessibility, and the broad variety of uses. The presence or absence of lead-based paint or lead-based paint hazards applies only to the tested or assessed surfaces on the date of the field visit. It should be understood that conditions noted within this report were accurate at the time of the inspection and in no way reflect the conditions at the property after the date of the inspection. All data collection, findings, conclusions and recommendations presented by FCG within this report are based upon limited data using current standard practices accepted within the industry. The conclusions and recommendations presented within this report are based on current regulations and the professional experience of the certified professionals involved in this project.

The data collected during this assessment and any resulting recommendations shall be used only by the client for the site described in this report. Any use or reliance of this report by a third party, including any of its information or recommendations, without the explicit authorization of the client shall be strictly at the risk of the third party.

It should not be misconstrued that this assessment has identified any or all environmental conditions at the subject site. FCG makes no representations regarding the accuracy of the enclosed data and will not be held responsible for any incidental or consequential loss or punitive damages including but not limited to, loss of profits or revenues, loss of use of a facility or land, delay in construction or action of regulatory agencies.

If you have any questions or concerns regarding the information provided, please do not hesitate to call us at 805.646.1995.

FCG Environmental



Alan Forbess, Principal Consultant
CA Certified Asbestos Consultant (CAC No. 94-1549)

Attachments: Site Plan with Buildings Labeled

- 1 – Laboratory Results for Asbestos, Bulk Sample Logs & Chain of Custody
- 2 – XRF Field Readings Table and Sampling Methodology
- 3 – FCG Inspector Certifications
- 4 – Lead Safe Work Practices

D side



C side



A side

B side

Site Plan - Terminal 2
5353 Overpass Road
Goleta, CA 93111

Attachment 1

Laboratory Analytical Results for Asbestos Bulk Samples

Bulk Sample Log Sheet/Chain-of-Custody



Bulk Asbestos Analysis

(EPA Method 40CFR, Part 763, Appendix E to Subpart E and EPA 600/R-93-116, Visual Area Estimation)

NVLAP Lab Code: 101459-1

Forbess Consulting Group (FCG)

Alan Forbess

1009 Mercer Avenue

Ojai, CA 93023

Client ID: 7238

Report Number: B333518

Date Received: 05/25/22

Date Analyzed: 05/27/22

Date Printed: 05/27/22

First Reported: 05/27/22

Job ID/Site: SBMTD-02; 5353 Overpass Rd.

SGSFL Job ID: 7238

Date(s) Collected: 05/24/2022

Total Samples Submitted: 46

Total Samples Analyzed: 46

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
1	51550376						
Layer: Grey Cementitious Material			ND				
Layer: Off-White Cementitious Material			ND				
Layer: Paint			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							
2	51550377						
Layer: Grey Cementitious Material			ND				
Layer: Off-White Cementitious Material			ND				
Layer: Paint			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							
3	51550378						
Layer: Grey Cementitious Material			ND				
Layer: Off-White Cementitious Material			ND				
Layer: Paint			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							
4	51550379						
Layer: Grey Roof Shingles			ND				
Layer: Black Tar			ND				
Layer: Wood			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (5 %) Fibrous Glass (45 %)							
5	51550380						
Layer: Grey Roof Shingles			ND				
Layer: Black Tar			ND				
Layer: Black Felt			ND				
Layer: Wood			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (15 %) Fibrous Glass (45 %)							

Client Name: Forbess Consulting Group (FCG)

Report Number: B333518

Date Printed: 05/27/22

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
6	51550381						
Layer: White Non-Fibrous Mat'l with Debris			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							
7	51550382						
Layer: White Non-Fibrous Mat'l with Debris			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							
8	51550383						
Layer: Black/White Non-Fibrous Mat'l			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							
9	51550384						
Layer: Black/White Non-Fibrous Mat'l			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							
10	51550385						
Layer: White/Grey Non-Fibrous Mat'l			ND				
Layer: Black Semi-Fibrous Tar		Chrysotile	2 %				
Total Composite Values of Fibrous Components:		Asbestos (Trace)					
Cellulose (Trace)							
11	51550386						
Layer: Black Tar			ND				
Layer: Black Felts			ND				
Layer: Wood			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (7 %) Fibrous Glass (35 %)							
12	51550387						
Layer: Black Tar			ND				
Layer: Black Felts			ND				
Layer: Wood			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (7 %) Fibrous Glass (35 %)							
13	51550388						
Layer: Black Semi-Fibrous Tar		Chrysotile	2 %				
Layer: Stones			ND				
Layer: Black Tar			ND				
Layer: Black Felt			ND				
Total Composite Values of Fibrous Components:		Asbestos (2%)					
Cellulose (Trace)							

Client Name: Forbess Consulting Group (FCG)

Report Number: B333518

Date Printed: 05/27/22

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
14	51550389						
Layer: Off-White Non-Fibrous Material			ND				
Layer: Silver Paint		Chrysotile	2 %				
Total Composite Values of Fibrous Components:		Asbestos (Trace)					
Cellulose (Trace)							
Comment: This comment applies to the Silver Paint only: Due to small sample size, this result may not be repeatable.							
15	51550390						
Layer: Grey Non-Fibrous Mat'l with Debris			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							
16	51550391						
Layer: Tan Tile			ND				
Layer: Tan Mastic			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							
17	51550392						
Layer: Tan Tile			ND				
Layer: Tan Mastic			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							
18	51550393						
Layer: Tan Tile			ND				
Layer: Tan Mastic			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							
19	51550394						
Layer: Tan Non-Fibrous Material			ND				
Layer: Brown Mastic			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							
20	51550395						
Layer: Tan Non-Fibrous Material			ND				
Layer: Brown Mastic			ND				
Layer: Off-White Joint Compound			ND				
Layer: Fibrous Backing			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							
21	51550396						
Layer: Brown Mastic			ND				
Layer: Off-White Joint Compound			ND				
Layer: Fibrous Backing			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (5 %)							

Client Name: Forbess Consulting Group (FCG)

Report Number: B333518

Date Printed: 05/27/22

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
22	51550397						
Layer: Beige Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (35 %)	Fibrous Glass (45 %)						
23	51550398						
Layer: Beige Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (35 %)	Fibrous Glass (45 %)						
24	51550399						
Layer: Beige Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (35 %)	Fibrous Glass (45 %)						
25	51550400						
Layer: White Drywall			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (20 %)	Fibrous Glass (Trace)						
26	51550401						
Layer: White Drywall			ND				
Layer: White Joint Compound			ND				
Layer: Drywall Tape			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (10 %)	Fibrous Glass (Trace)						
27	51550402						
Layer: White Drywall			ND				
Layer: White Joint Compound			ND				
Layer: Drywall Tape			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (10 %)	Fibrous Glass (Trace)						

Client Name: Forbess Consulting Group (FCG)

Report Number: B333518

Date Printed: 05/27/22

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
28	51550403						
Layer: Brown Drywall			ND				
Layer: White Joint Compound			ND				
Layer: Drywall Tape			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (10 %) Fibrous Glass (Trace)							
29	51550404						
Layer: White Drywall			ND				
Layer: White Joint Compound			ND				
Layer: Drywall Tape			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (20 %) Fibrous Glass (Trace)							
30	51550405						
Layer: White Drywall			ND				
Layer: White Joint Compound			ND				
Layer: Drywall Tape			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (10 %) Fibrous Glass (Trace)							
31	51550406						
Layer: White Drywall			ND				
Layer: White Joint Compound			ND				
Layer: Drywall Tape			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (10 %) Fibrous Glass (Trace)							
32	51550407						
Layer: Beige Woven Material			ND				
Layer: Paint			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (75 %)							
33	51550408						
Layer: Off-White Woven Mat'l with Paint			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace) Fibrous Glass (85 %)							

Report Number: B333518

Date Printed: 05/27/22

Client Name: Forbess Consulting Group (FCG)

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
34	51550409						
Layer: Grey Non-Fibrous Material			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							
35	51550410						
Layer: Grey Cementitious Material			ND				
Layer: Off-White Cementitious Material			ND				
Layer: Paint			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							
36	51550411						
Layer: Brown Non-Fibrous Material			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							
37	51550412						
Layer: Grey Roof Shingle			ND				
Layer: Black Tar			ND				
Layer: Black Felt			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (20 %) Fibrous Glass (25 %)							
38	51550413						
Layer: Grey Roof Shingle			ND				
Layer: Black Tar			ND				
Layer: Black Felt			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (20 %) Fibrous Glass (25 %)							
39	51550414						
Layer: Black Semi-Fibrous Tar		Chrysotile	3 %				
Layer: Stones			ND				
Layer: Black Tar			ND				
Layer: Black Felt			ND				
Total Composite Values of Fibrous Components:		Asbestos (3%)					
Cellulose (Trace)							
40	51550415						
Layer: Black Semi-Fibrous Tar		Chrysotile	3 %				
Total Composite Values of Fibrous Components:		Asbestos (3%)					
Cellulose (Trace)							
41	51550416						
Layer: Black Tars			ND				
Layer: Black Felts			ND				
Layer: Beige Fibrous Material			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (55 %) Fibrous Glass (15 %)							

Client Name: Forbess Consulting Group (FCG)

Report Number: B333518

Date Printed: 05/27/22

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
42	51550417						
Layer: Black Tars			ND				
Layer: Black Felts			ND				
Layer: Beige Fibrous Material			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (55 %)	Fibrous Glass (15 %)						
43	51550418						
Layer: Grey Roof Shingles			ND				
Layer: Black Tar			ND				
Layer: Black Felt			ND				
Layer: Beige Fibrous Material			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (5 %)	Fibrous Glass (40 %)						
44	51550419						
Layer: Grey Roof Shingles			ND				
Layer: Black Tar			ND				
Layer: Black Felt			ND				
Layer: Beige Fibrous Material			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (5 %)	Fibrous Glass (40 %)						
45	51550420						
Layer: Black Semi-Fibrous Tar		Chrysotile	3 %				
Total Composite Values of Fibrous Components:		Asbestos (3%)					
Cellulose (Trace)							
46	51550421						
Layer: Black Non-Fibrous Material			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							



Tiffani Ludd, Laboratory Supervisor, Carson Laboratory

Note: Limit of Quantification ('LOQ') = 1%. 'Trace' denotes the presence of asbestos below the LOQ. 'ND' = 'None Detected'.

Analytical results and reports are generated by SGS Forensic Laboratories (SGSFL) at the request of and for the exclusive use of the person or entity (client) named on such report. Results, reports or copies of same will not be released by SGSFL to any third party without prior written request from client. This report applies only to the sample(s) tested. Supporting laboratory documentation is available upon request. This report must not be reproduced except in full, unless approved by SGSFL. The client is solely responsible for the use and interpretation of test results and reports requested from SGSFL. SGSFL is not able to assess the degree of hazard resulting from materials analyzed. SGS Forensic Laboratories reserves the right to dispose of all samples after a period of thirty (30) days, according to all state and federal guidelines, unless otherwise specified. All samples were received in acceptable condition unless otherwise noted.



FORENSIC
LABORATORIES

Analysis Request Form (COC)

Client Name & Address: FCG Environmental (Forbess Consulting Group, Inc.) 1009 Mercer Avenue Ojai, CA 93023		Client No.: 7238	PO / Job#: SBMTD-02	Date: 5-24-22
Contact: Alan Forbess		Phone: (805) 646-1995	Turn Around Time: Same Day / 1Day / 2Day / 3Day / 4Day / 5Day	
E-mail: aforbess@fcgenviro.com		<input type="checkbox"/> PCM: <input type="checkbox"/> NIOSH 7400A / <input type="checkbox"/> NIOSH 7400B <input type="checkbox"/> Rotometer <input checked="" type="checkbox"/> PLM: <input checked="" type="checkbox"/> Standard / <input type="checkbox"/> Point Count 400 - 1000 / <input type="checkbox"/> CARB 435		
Site Name: 5353 Overpass Rd.		<input type="checkbox"/> TEM Air: <input type="checkbox"/> AHERA / <input type="checkbox"/> Yamate2 / <input type="checkbox"/> NIOSH 7402 <input type="checkbox"/> TEM Bulk: <input type="checkbox"/> Quantitative / <input type="checkbox"/> Qualitative / <input type="checkbox"/> Chatfield <input type="checkbox"/> TEM Water: <input type="checkbox"/> Potable / <input type="checkbox"/> Non-Potable / <input type="checkbox"/> Weight % <input type="checkbox"/> TEM Microvac: <input type="checkbox"/> Qual / <input type="checkbox"/> D5755(str/area) / <input type="checkbox"/> D5756(str/mass)		
Site Location:		<input type="checkbox"/> IAQ Particle Identification (PLM LAB) <input type="checkbox"/> PLM Opaques/Soot <input type="checkbox"/> Particle Identification (TEM LAB) <input type="checkbox"/> Special Project		
Comments:		<input type="checkbox"/> Metals Analysis Matrix: Method: Analytes: <input type="checkbox"/> Silica in Air <input type="checkbox"/> w/Gravimetry <input type="checkbox"/> Quartz Only		

Sample ID	Date / Time	Sample Location / Description	FOR AIR SAMPLES ONLY				Sample Area / Air Volume
			Type	Time On/Off	Avg LPM	Total Time	
		Samples 1-46 See Attached log	<input type="checkbox"/> A <input type="checkbox"/> P <input type="checkbox"/> C				
			<input type="checkbox"/> A <input type="checkbox"/> P <input type="checkbox"/> C				
			<input type="checkbox"/> A <input type="checkbox"/> P <input type="checkbox"/> C				
			<input type="checkbox"/> A <input type="checkbox"/> P <input type="checkbox"/> C				
			<input type="checkbox"/> A <input type="checkbox"/> P <input type="checkbox"/> C				
			<input type="checkbox"/> A <input type="checkbox"/> P <input type="checkbox"/> C				
			<input type="checkbox"/> A <input type="checkbox"/> P <input type="checkbox"/> C				
			<input type="checkbox"/> A <input type="checkbox"/> P <input type="checkbox"/> C				
			<input type="checkbox"/> A <input type="checkbox"/> P <input type="checkbox"/> C				
			<input type="checkbox"/> A <input type="checkbox"/> P <input type="checkbox"/> C				

Sampled By: BRF	Date/Time: 5-24-22 8:00 AM	Shipped Via: <input checked="" type="checkbox"/> Fed Ex <input type="checkbox"/> UPS <input type="checkbox"/> US Mail <input type="checkbox"/> Courier <input type="checkbox"/> Drop Off <input type="checkbox"/> Other:
Relinquished By:	Relinquished By:	Relinquished By:
Date / Time: 5-24-22 4:00 PM	Date / Time:	Date / Time:
Received By:	Received By:	Received By:
Date / Time: 5-25-22 9:42 AM	Date / Time:	Date / Time:
Condition Acceptable? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No BUS	Condition Acceptable? <input type="checkbox"/> Yes <input type="checkbox"/> No	Condition Acceptable? <input type="checkbox"/> Yes <input type="checkbox"/> No

SGS Forensic Laboratories may subcontract client samples to other SGSFL locations to meet client requests.

San Francisco Office: 3777 Depot Road, Suite 409, Hayward, CA 94545-2761 • Phone: 510/887-8828 • 800/827-3274
 Los Angeles Office: 2959 Pacific Commerce Drive, Rancho Dominguez, CA 90221 • Phone: 310/763-2374 • 888/813-9417
 Las Vegas Office: 6765 S. Eastern Avenue, Suite 3, Las Vegas, NV 89119 • Phone: 702/784-0040

FCG Environmental

Asbestos Bulk Sampling Field Log

Date: 5-24-22
Client: SBMTD
Site: 5353 overpass Rd.
Project: SBMTD-02
Inspector(s): BRF
Area/Unit: Int + Ext Full Survey

Friable: Friability Codes: N=Non-friable; F=Friable

Cond: Condition Codes: G=Good; F=Fair; P=Poor

NA=Not Analyzed

ND=Detected

N=Negative

1 of 4

Sample #	Material Sampled	Sample Location	Quantity	Notes	Friability	Condition
1	Ext. Stucco	Office + East / Bus Maint. / End / South Side	T/O		N	G
2	↓	↓	↓		↓	↓
3	↓	↓	↓		↓	↓
4	Roof layers / Comp. Shingle	East / Pitched / South Side	↓		N	G
5	↓	↓	↓		↓	↓
6	Roof Coating / White	Upper / Metal Roof / ↓	↓		N	F
7	↓	↓	↓		↓	↓
8	Roof Caulking / White over Black	at base of / Root Air Vents	66 LF	3 Rectangular Vents	N	F
9	↓	↓	↓		↓	↓
10	↓	↓	↓		↓	↓
11	Roof layers / Hot mop w/stones	South / Flat Roof / East overhang	T/O		N	F
12	↓	↓	↓		↓	↓

FCG Environmental

Asbestos Bulk Sampling Field Log

Date: 5-14-22
Client: SBMTD
Site: 5353 Overpass Rd.
Project: SBMTD-02
Inspector(s): BRF
Area/Unit: Full Survey

2 of 4

Friable: Friability Codes: N=Non-friable; F=Friable

Cond: Condition Codes: G=Good; F=Fair; P=Poor

NA=Not Analyzed

ND=Detected

N=Negative

Sample #	Material Sampled	Sample Location	Quantity	Notes	Friability	Condition
13	Roof Mastic/Black	Office + Bus Maint. / South Flat Roof / Curb corner	20SF	Corner, Pens + Drip edge Flashing Corners	N	P
14	HVAC Duct Seams/white	/ at lower seam	10SF		N	F
15	Ext. Grey Caulking	/ at Louvered Vents + HVAC Pen.	35LF	on wall near HVAC unit	N	F
16	Brown 12" VFT w/ Yellow Mastic	1 Break Room	1250SF		N	P
17	↓	1 Hallway	↓		↓	↓
18	↓	1 SW office	↓		↓	↓
19	Tan 4" Covebase w/ Brown Mastic	1 T T	T/O		N	P
20	↓	1 Room w/ Stairs to Mezzanine	↓		↓	↓
21	Brown Cove Base Mastic	1 Break Room	↓		↓	↓
22	2x2" Drop Ceiling tiles	1 Hallway	1500SF		F	F
23	↓	1 SE office	↓		↓	↓
24	↓	↓ 1 NE office	↓		↓	↓

FCG Environmental

Asbestos Bulk Sampling Field Log

Date: 5-24-22
Client: SBMTD
Site: 5353 Overpass Rd.
Project: SBMTD-02
Inspector(s): BRF
Area/Unit: Full Survey

3 of 4

Friable: Friability Codes: N=Non-friable; F=Friable

Cond: Condition Codes: G=Good; F=Fair; P=Poor

NA=Not Analyzed

ND=Detected

N=Negative

Sample #	Material Sampled	Sample Location	Quantity	Notes	Friability	Condition
25	Drywall/Joint Compound	Office Security Coiling Bus Maint. Room above Drop	T/O		N	F
26	/	/ Hallway / SE Corner	/		/	/
27	/	/ NW Office / NW	/		/	/
28	/	/ Maint. RR / SW	/		/	/
29	/	/ Mezzanine / West Wall	/		/	/
30	/	/ Bus Garage / South Wall	/		/	/
31	/	/ Utility Room / SW Corner	/		/	/
32	Duct Seam Tape	Bus West Near Exhaust Garage Bay Blower	T/O Bus Maint.		N	F
33	Beige Vibration Gasket	/ Exhaust Blower	2 at Blower 2 at HVAC unit on South Roof		N	F
34	Ext. Metal Siding / Grey Bolt Washer	/ West Side	All Bolts		N	G
35	Ext. Stucco Eave	/ South Eave	T/O		N	G
36	Equipment lid Gasket Brown	Bus Wash area / Top side of Blue Equipment	2 lids 25 LF		F	P

FCG Environmental

Asbestos Bulk Sampling Field Log

Date: 5-24-22
Client: SBMTD
Site: 5353 Overpass Rd.
Project: SBMTD-02
Inspector(s): BRF
Area/Unit: Full Survey

Friable: Friability Codes: N=Non-friable; F=Friable

Cond: Condition Codes: G=Good; F=Fair; P=Poor

NA=Not Analyzed

ND=Detected

N=Negative

4 of 4

Sample #	Material Sampled	Sample Location	Quantity	Notes	Friability	Condition
37	Roof layers/Comp. Sheet w/Insulation	Bus Wash area/Equipment Canopy	T/O	over metal	N	P
38	↓ ↓ ↓ ↓	↓ Washing Bldg.	T/O	↓	↓	↓
39	Roof Mastic/Black	↓ Equipment Canopy	80 LF	under Top side of Drip Edge Flashing	N	F
40	↓ ↓ ↓ ↓	South Bus Parking Canopy/under Top side of Drip Edge Flashing	T/O		N	F
41	Roof layers/Comp. Sheet w/Insulation	↓ East Side	T/O	Over Metal	N	P
42	↓ ↓ ↓ ↓	↓ West Side	↓	↓	↓	↓
43	↓ ↓ ↓ ↓	North Bus Parking Canopy/East Side	↓	↓	↓	↓
44	↓ ↓ ↓ ↓	↓ West Side	↓	↓	↓	↓
45	Roof Mastic/Black	↓ under Top side of Drip Edge Flashing	T/O		N	F
46	Black Caulking/Ext.	office Maint. Bldg./at wood panels Below Windows	80 LF	Behind wood Trim	N	F

Attachment 2

Table of XRF Field Readings for Lead

XRF Sampling Methodology

Table of XRF Field Readings for Lead Paint & Lead Components
SBMTD Terminal 2
5353 Overpass Road, Goleta, CA 93111
[A Side = East]

Component	Substrate	Side	Condition	Color	Area	Building	Results	Lead mg/cm ²
CALIBRATE							Positive	1.1
CALIBRATE							Positive	1
CALIBRATE							Positive	1
WALL	STUCCO	A	INTACT	WHITE	OUTSIDE	OFFICE & MAINT BLDG	Negative	0
WALL	STUCCO	B	INTACT	WHITE	OUTSIDE	OFFICE & MAINT BLDG	Negative	0
WALL	STUCCO	D	INTACT	WHITE	OUTSIDE	OFFICE & MAINT BLDG	Negative	0
EAVE	STUCCO	D	INTACT	WHITE	OUTSIDE	OFFICE & MAINT BLDG	Negative	0
DOWNSPOUT	METAL	D	FAIR	WHITE	OUTSIDE	OFFICE & MAINT BLDG	Negative	0.02
RAIN GUTTER	METAL	D	FAIR	BROWN	OUTSIDE	OFFICE & MAINT BLDG	Negative	0.01
WALL	WOOD AT WINDOWS	D	FAIR	BROWN	OUTSIDE	OFFICE & MAINT BLDG	Negative	0
WINDOW TR	WOOD	D	FAIR	BROWN	OUTSIDE	OFFICE & MAINT BLDG	Negative	0
WINDOW SILL	WOOD	D	FAIR	BROWN	OUTSIDE	OFFICE & MAINT BLDG	Negative	0
WINDOW FR	WOOD	D	FAIR	BROWN	OUTSIDE	OFFICE & MAINT BLDG	Negative	0
WINDOW	METAL	D	FAIR	BLK	OUTSIDE	OFFICE & MAINT BLDG	Negative	0
DOOR	WOOD	D	FAIR	BEIGE	OUTSIDE	OFFICE & MAINT BLDG	Negative	0
DOOR WINDOW FR	METAL	D	FAIR	BEIGE	OUTSIDE	OFFICE & MAINT BLDG	Negative	0
DOOR FR	METAL	D	FAIR	BROWN	OUTSIDE	OFFICE & MAINT BLDG	Negative	0
DOOR JM	METAL	D	INTACT	WHITE	OUTSIDE	OFFICE & MAINT BLDG	Negative	0.02
DOOR TR	WOOD	D	INTACT	BROWN	OUTSIDE	OFFICE & MAINT BLDG	Negative	0
WALL	METAL	D	FAIR	WHITE	OUTSIDE	OFFICE & MAINT BLDG	Negative	0.05
WALL	METAL	C	FAIR	WHITE	OUTSIDE	OFFICE & MAINT BLDG	Negative	0.01
WALL	METAL	B	FAIR	WHITE	OUTSIDE	OFFICE & MAINT BLDG	Negative	0.02
BAY DOOR	METAL	D	POOR	TAN	OUTSIDE	OFFICE & MAINT BLDG	Negative	0.02
BAY DOOR FR	METAL	D	INTACT	WHITE	OUTSIDE	OFFICE & MAINT BLDG	Negative	0.06
BAY DOOR FR	METAL	D	POOR	BLK	OUTSIDE	OFFICE & MAINT BLDG	Negative	0.05
BAY DOOR FR	METAL	D	POOR	YELLOW	OUTSIDE	OFFICE & MAINT BLDG	Positive	1.8
EAVES	METAL	D	POOR	WHITE	OUTSIDE	OFFICE & MAINT BLDG	Negative	0.1

Table of XRF Lead Readings, continued

SBMTD Terminal 2
5353 Overpass Road, Goleta

Component	Substrate	Side	Condition	Color	Area	Building	Results	Lead mg/cm ²
RAFTER TAILS AT BIS MAINT	METAL	D	POOR	WHITE	OUTSIDE	OFFICE & MAINT BLDG	Negative	0.1
FASCIA AT OFFICE SECTION	WOOD	D	POOR	BROWN	OUTSIDE	OFFICE & MAINT BLDG	Negative	0
DOOR	WOOD	C	FAIR	BEIGE	OUTSIDE	OFFICE & MAINT BLDG	Negative	0
DOOR FR	WOOD	C	FAIR	BROWN	OUTSIDE	OFFICE & MAINT BLDG	Negative	0
DOOR JM	METAL	C	POOR	WHITE	OUTSIDE	OFFICE & MAINT BLDG	Negative	0.01
BAY DOOR	METAL	B	POOR	TAN	OUTSIDE	OFFICE & MAINT BLDG	Negative	0.02
BAY DOOR FR	METAL	B	FAIR	WHITE	OUTSIDE	OFFICE & MAINT BLDG	Negative	0.02
BAY DOOR FR	METAL	B	POOR	BLK	OUTSIDE	OFFICE & MAINT BLDG	Negative	0.02
BAY DOOR FR	METAL	B	POOR	YELLOW	OUTSIDE	OFFICE & MAINT BLDG	Positive	2.5
WALL	DRYWALL	A	POOR	WHITE	BUS GARAGE	OFFICE & MAINT BLDG	Negative	0
WALL	DRYWALL	B	POOR	WHITE	BUS GARAGE	OFFICE & MAINT BLDG	Negative	0
WALL	DRYWALL	C	POOR	WHITE	BUS GARAGE	OFFICE & MAINT BLDG	Negative	0
WALL	METAL	C	FAIR	WHITE	BUS GARAGE	OFFICE & MAINT BLDG	Negative	0
LOWER WALL	WOOD	A	FAIR	WHITE	BUS GARAGE	OFFICE & MAINT BLDG	Negative	0
LOWER WALL	WOOD	B	FAIR	WHITE	BUS GARAGE	OFFICE & MAINT BLDG	Negative	0
DIVIDING WALL	WOOD	C	POOR	WHITE	BUS GARAGE	OFFICE & MAINT BLDG	Negative	0
COLUMN	WOOD	B	INTACT	BEIGE	BUS GARAGE	OFFICE & MAINT BLDG	Negative	0.03
BEAM	METAL	B	INTACT	BEIGE	BUS GARAGE	OFFICE & MAINT BLDG	Negative	0.01
RAFTER	METAL	B	INTACT	BEIGE	BUS GARAGE	OFFICE & MAINT BLDG	Negative	0.02
CEILING	METAL	B	POOR	WHITE	BUS GARAGE	OFFICE & MAINT BLDG	Negative	0.01
BAY DOOR	METAL	D	POOR	GREY	BUS GARAGE	OFFICE & MAINT BLDG	Negative	0.03
DUCTING	METAL	D	POOR	WHITE	BUS GARAGE	OFFICE & MAINT BLDG	Negative	0.01
BLOWER	METAL	D	FAIR	WHITE	BUS GARAGE	OFFICE & MAINT BLDG	Negative	0
COMPRESSOR TANK	METAL	A	FAIR	BLUE	UTILITY RM	OFFICE & MAINT BLDG	Negative	0
COMPRESSOR TMOTOR	METAL	A	FAIR	GREEN	UTILITY RM	OFFICE & MAINT BLDG	Negative	0
WALL	DRYWALL	A	FAIR	WHITE	UTILITY RM	OFFICE & MAINT BLDG	Negative	0
CEILING	DRYWALL	A	FAIR	WHITE	UTILITY RM	OFFICE & MAINT BLDG	Negative	0
DOOR	METAL	B	FAIR	GREY	UTILITY RM	OFFICE & MAINT BLDG	Negative	0
DOOR FR	METAL	B	POOR	WHITE	UTILITY RM	OFFICE & MAINT BLDG	Negative	0

Table of XRF Lead Readings, continued

SBMTD Terminal 2
5353 Overpass Road, Goleta

Component	Substrate	Side	Condition	Color	Area	Building	Results	Lead mg/cm ²
WALL	CERAMIC TILE	ALL SIDES	INTACT	TAN	MAINT RR	OFFICE & MAINT BLDG	Positive	7
FLOOR	CERAMIC TILE	ALL SIDES	INTACT	BEIGE	MAINT RR	OFFICE & MAINT BLDG	Negative	0
WALL	DRYWALL	B	INTACT	WHITE	MAINT RR	OFFICE & MAINT BLDG	Negative	0
CEILING	DRYWALL	B	INTACT	WHITE	MAINT RR	OFFICE & MAINT BLDG	Negative	0
DOOR	WOOD	C	INTACT	BROWN	MAINT RR	OFFICE & MAINT BLDG	Negative	0.05
SINK	PORC	A	INTACT	WHITE	MAINT RR	OFFICE & MAINT BLDG	Positive	8.8
WALL	DRYWALL	C	FAIR	WHITE	MEZZANINE	OFFICE & MAINT BLDG	Negative	0
RAFTER	METAL	C	INTACT	RED	MEZZANINE	OFFICE & MAINT BLDG	Negative	0.02
BEAM	METAL	A	INTACT	RED	MEZZANINE	OFFICE & MAINT BLDG	Negative	0
WALL AT MOP SINK	CERAMIC TILE	B	INTACT	BEIGE	JANITOR CLOSET	OFFICE & MAINT BLDG	Positive	9.1
MOP SINK	PORC	B	INTACT	WHITE	JANITOR CLOSET	OFFICE & MAINT BLDG	Positive	9.9
SINK	PORC	B	INTACT	WHITE	BREAK RM	OFFICE & MAINT BLDG	Positive	31.4
CABINET	WOOD	B	INTACT	BROWN	BREAK RM	OFFICE & MAINT BLDG	Negative	0
WINDOW TR	WOOD	A	INTACT	WHITE	BREAK RM	OFFICE & MAINT BLDG	Negative	0
WALL	DRYWALL	D	INTACT	WHITE	BREAK RM	OFFICE & MAINT BLDG	Negative	0.01
CEILING	DRYWALL	D	INTACT	WHITE	BREAK RM	OFFICE & MAINT BLDG	Negative	0
CEILING	DRYWALL	D	INTACT	WHITE	MENS RR	OFFICE & MAINT BLDG	Negative	0
WALL	DRYWALL	D	INTACT	WHITE	MENS RR	OFFICE & MAINT BLDG	Negative	0
WALL	CERAMIC TILE	ALL	INTACT	BEIGE	MENS RR	OFFICE & MAINT BLDG	Positive	9.4
SINK	PORC	A	INTACT	WHITE	MENS RR	OFFICE & MAINT BLDG	Positive	6.2
URINAL	PORC	A	INTACT	WHITE	MENS RR	OFFICE & MAINT BLDG	Negative	0.01
SINK	PORC	A	INTACT	WHITE	WOMENS RR	OFFICE & MAINT BLDG	Positive	1.1
TOILET	PORC	A	INTACT	WHITE	WOMENS RR	OFFICE & MAINT BLDG	Negative	0
WALL	CERAMIC TILE	ALL SIDES	INTACT	BEIGE	WOMENS RR	OFFICE & MAINT BLDG	Positive	7.1
WALL	DRYWALL	A	INTACT	WHITE	WOMENS RR	OFFICE & MAINT BLDG	Negative	0
CEILING	DRYWALL	A	INTACT	WHITE	WOMENS RR	OFFICE & MAINT BLDG	Negative	0
COLUMN	METAL	A	FAIR	TAN	OUTSIDE	NORTH BUS CANOPY	Negative	0
COLUMN	METAL	A	FAIR	BLK	OUTSIDE	NORTH BUS CANOPY	Negative	0
COLUMN	METAL	A	FAIR	YELLOW	OUTSIDE	NORTH BUS CANOPY	Positive	2.9

Table of XRF Lead Readings, continued

SBMTD Terminal 2
5353 Overpass Road, Goleta

Component	Substrate	Side	Condition	Color	Area	Building	Results	Lead mg/cm ²
BEAM	METAL	A	FAIR	TAN	OUTSIDE	NORTH BUS CANOPY	Negative	0
FASCIA	METAL	A	POOR	BROWN	OUTSIDE	NORTH BUS CANOPY	Negative	0
WALL	CONCRETE BLOCK	A	INTACT	BEIGE	OUTSIDE	BUS WASH BLDG	Negative	0
WALL	CONCRETE BLOCK	B	INTACT	BEIGE	OUTSIDE	BUS WASH BLDG	Negative	0
WALL	CONCRETE BLOCK	C	INTACT	BEIGE	OUTSIDE	BUS WASH BLDG	Negative	0
WALL	CONCRETE BLOCK	D	INTACT	BEIGE	OUTSIDE	BUS WASH BLDG	Negative	0
CONTROL BOX	METAL	A	POOR	BLUE	OUTSIDE	BUS WASH BLDG	Negative	0.01
WALL	CONCRETE BLOCK	A	POOR	BEIGE	INSIDE	BUS WASH BLDG	Negative	0
COLUMN	METAL	A	POOR	BLK	INSIDE	BUS WASH BLDG	Negative	0.17
BEAM	METAL	A	POOR	BLK	INSIDE	BUS WASH BLDG	Negative	0.11
WASH EQUIPMENT	METAL	B	POOR	BLUE	OUTSIDE	BUS WASH BLDG	Negative	0.02
WASH EQUIPMENT PIPE	METAL	B	POOR	BLUE	OUTSIDE	BUS WASH BLDG	Negative	0.12
COLUMN	METAL	B	POOR	TAN	OUTSIDE	EQUIPMENT CANOPY	Negative	0
BEAM	METAL	B	POOR	TAN	OUTSIDE	EQUIPMENT CANOPY	Negative	0
FASCIA	METAL	B	POOR	BROWN	OUTSIDE	EQUIPMENT CANOPY	Negative	0
FASCIA	METAL	B	POOR	BROWN	OUTSIDE	SOUTH BUS CANOPY	Negative	0
COLUMN	METAL	A	POOR	TAN	OUTSIDE	SOUTH BUS CANOPY	Negative	0
BEAM	METAL	A	POOR	TAN	OUTSIDE	SOUTH BUS CANOPY	Negative	0
DOWNSPOUT	METAL	B	POOR	TAN	OUTSIDE	SOUTH BUS CANOPY	Negative	0.01
CALIBRATE							Positive	1.1
CALIBRATE							Positive	1.1
CALIBRATE							Positive	1.1

XRF Sampling Methodology: All inspections include a visual inspection of site surfaces to identify painted components and general site conditions. Field testing is performed by a CA Certified Lead Inspector/Assessor using a Niton X-Ray fluorescence (XRF) lead paint analyzer. The XRF sampling method uses a field instrument (X-Ray Fluorescence or XRF gun) to characterize suspect painted surfaces and components. XRF equipment is used to sample materials suspected of being coated with lead-based paint and lead-containing materials by “reading” the suspect materials through direct contact. The advantage of this method is that it provides instantaneous results and is a non-destructive method which allows for the collection of as many samples as time allows for the daily cost of the instrument. This survey method can also identify lead in ceramic tiles, porcelain or other suspect building materials. The survey attempts to define the extent of LBP and estimate quantities where possible. Paint is determined positive using the CA Dept. of Health Services criteria of 1.0 milligrams per square centimeter (mg/cm²). During the survey, the front or main side of the building is typically designated as the “A” side, with the remaining sides designated as “B”, “C” and “D” continuing in a clockwise manner. Where appropriate, a field sketch or plot plan is provided.

Instrument Calibration: The calibration of the Niton XLP 300A X-Ray fluorescence (XRF) instrument is done in accordance with the Performance Characteristic Sheet (PCS) for this instrument. These XRF instruments are calibrated using a calibration standard block of known lead content. Three calibration readings are taken before and after each property is tested to insure manufacturer’s standards are met. If the inspection is longer than 4 hours, a set of 3 calibration readings must be taken before the 4 hours expires, and then an additional 3 calibration readings taken at the end of the inspection. If for any reason the instruments are not maintaining a consistent calibration reading within the manufacturer’s standards for performance on the calibration block supplied by the manufacturer, manufacturer’s recommendations are used to bring the instrument into calibration. If the instrument cannot be brought back into calibration, it is taken off the site and sent back to the manufacturer for repair and/or re-calibration.

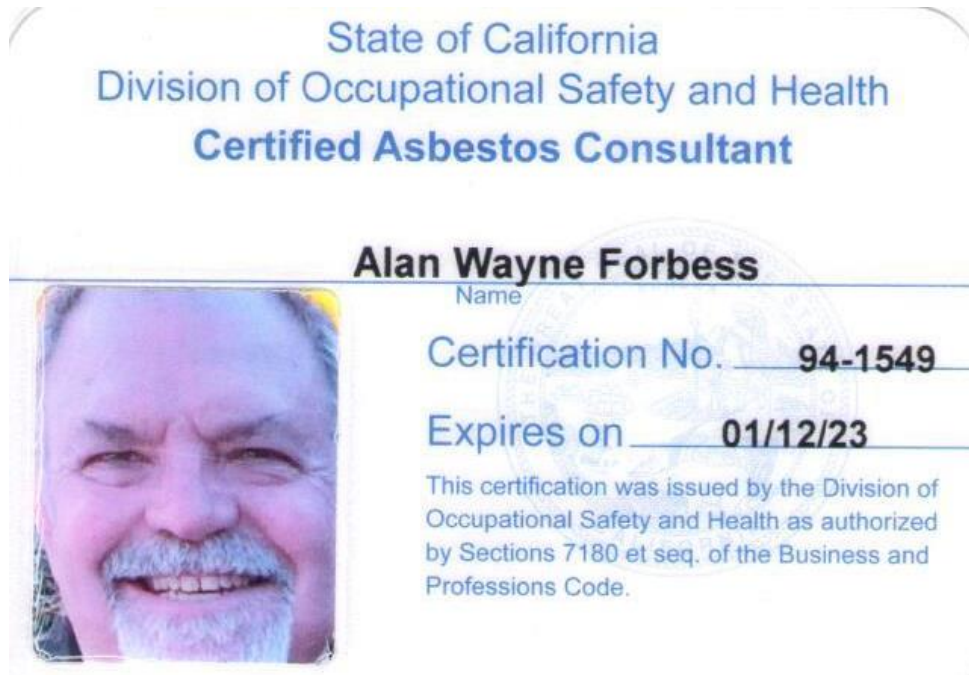
Inspector Training and Qualifications: All inspectors utilized by FCG are Certified Lead Inspectors/Assessors, having obtained certification through the *California Department of Public Health (CDPH)*. All inspectors have taken a State-certified 40 hour Inspector/Assessor course and passed the State Inspector/Assessor Exam. All FCG field personnel have also been trained in the use, calibration and maintenance of the X-Ray Fluorescence (XRF) equipment they currently use, along with necessary principles of radiation safety through a training program provided by the manufacturer.




Equipment Information: The field instrument used on this project was a Niton Model XLP 300A X-Ray fluorescence (XRF) lead paint analyzer (Serial No. 10106). The Niton instrument uses a high performance, electrically-cooled, solid-state detector optimized for lead (Pb) analysis using L-shell and K-shell x-ray detection. This instrument allows for XRF spectrum analysis in the field with automatic Positive/Negative decision and automatic corrections for substrate bias and age of source. All negative classifications in all paint-test modes are verified by negative K-shell x-ray readings. Please see Attachment 2 for a copy of the Performance Characteristic Sheet provided by Niton for the XLP 300A instrument. This document contains detailed information regarding the XRF instrument calibration, inconclusive range or thresholds for various substrates, operating parameters and other information. For more information on the Niton Model XLP 300A instrument, please visit the following website: www.thermo.com/niton

Attachment 3

FCG Inspector Certifications

Alan W. Forbess, Certifications (2022-2023)



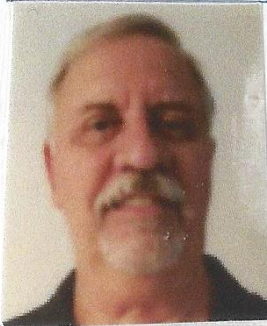
	STATE OF CALIFORNIA DEPARTMENT OF PUBLIC HEALTH			
LEAD-RELATED CONSTRUCTION CERTIFICATE				
INDIVIDUAL:	CERTIFICATE TYPE:	NUMBER:	EXPIRATION DATE:	
	Lead Inspector/Assessor Lead Project Monitor	LRC-00000505 LRC-00000504	6/18/2022 6/18/2022	
Alan Forbess				
<p>Disclaimer: This document alone should not be relied upon to confirm certification status. Compare the individual's photo and name to another valid form of government issued photo identification. Verify the individual's certification status by searching for Lead-Related Construction Professionals at www.cdph.ca.gov/programs/clpph or calling (800) 597-LEAD.</p>				



FCG Staff Certifications – William A. Miller

State of California
Division of Occupational Safety and Health
Certified Site Surveillance Technician

William A Miller



Name

Certification No. **07-4160**

Expires on **03/22/23**

This certification was issued by the Division of Occupational Safety and Health as authorized by Sections 7180 et seq. of the Business and Professions Code.



STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC HEALTH



LEAD-RELATED CONSTRUCTION CERTIFICATE

INDIVIDUAL:



William Miller

CERTIFICATE TYPE:

Lead Inspector/Assessor
Lead Project Monitor

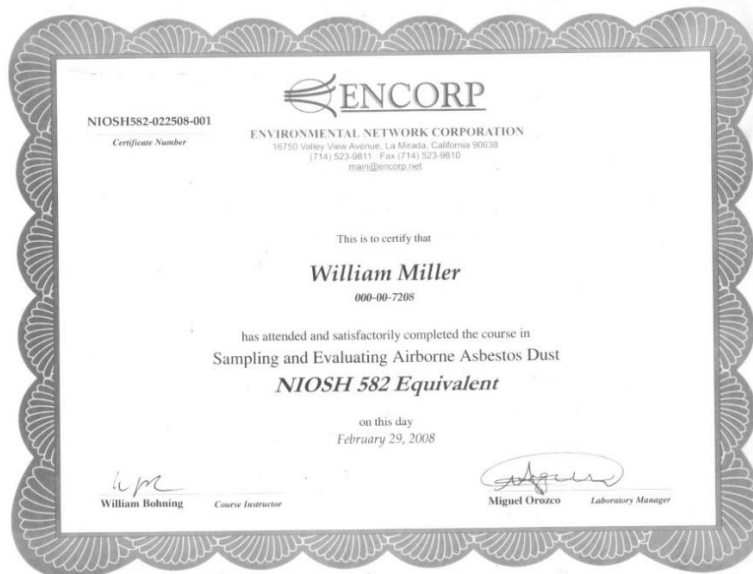
NUMBER:

LRC-00000721
LRC-00000720

EXPIRATION DATE:

6/13/2022
6/13/2022

Disclaimer: This document alone should not be relied upon to confirm certification status. Compare the individual's photo and name to another valid form of government issued photo identification. Verify the individual's certification status by searching for Lead-Related Construction Professionals at www.cdph.ca.gov/programs/clppb or calling (800) 597-LEAD.



Blake Forbess Certifications 2022

State of California
Division of Occupational Safety and Health
Certified Site Surveillance Technician



Blake R Forbess
Name

Certification No. **18-6328**


Expires on **11/15/22**

This certification was issued by the Division of Occupational Safety and Health as authorized by Sections 7180 et seq. of the Business and Professions Code.



 STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC HEALTH 

LEAD-RELATED CONSTRUCTION CERTIFICATE

INDIVIDUAL:	CERTIFICATE TYPE:	NUMBER:	EXPIRATION DATE:
 Blake Forbess	Lead Sampling Technician	LRC-00003725	10/31/2022

Disclaimer: This document alone should not be relied upon to confirm certification status. Compare the individual's photo and name to another valid form of government issued photo identification. Verify the individual's certification status by searching for Lead-Related Construction Professionals at www.cdph.ca.gov/programs/clppb or calling (800) 597-LEAD.

Attachment 4

Lead Safe Work Practices



Lead Safe Work Practices - General

Lead mitigation work will be performed in accordance with Title 17 and Title 8 of the California Code of Regulations, and with Section 1017 of the Residential Lead-Based Paint Hazard Reduction Act of 1992, better known as Title X or HUD. The Federal HUD Guidelines are the industry standard used for interim controls or abatement of lead hazards. This specification complies with Chapter 11: Interim Controls, Section II - Paint Film Stabilization.

Lead Safe Work Practices

1. All work where lead or lead-based paint will be disturbed shall be performed by lead-trained workers using appropriate controls to prevent lead dust and paint chip contamination of the site. Once the surfaces have been stabilized, normal contracting personnel may perform tasks as long as there is no generation of lead dust through “trigger tasks” such as grinding, sanding, cutting or similar actions where lead dust may be generated.
2. Exterior paint film stabilization will include the removal of loose, chipped, cracking, flaking, blistering, or chalking paint from the painted surfaces where LBP has been identified. Hand-scraping or sanding using wet methods, vacuum powered tools or chemical stripping are the only acceptable methods for removal of loose and flaking materials to bring the surfaces to an intact condition.
3. All loose and peeling paint that can be lifted with thumbnail pressure shall be removed. Surfaces shall be misted with water and kept wet during scraping and sanding operations. Any nails, screws, or other protrusions shall be removed if possible. All voids will be filled and sharp edges will be sanded.
4. Containment shall be in place prior to the start of any scraping activities or the removal of any lead-painted building components, ceramic tiles or porcelain fixtures. One layer of 6-mil polyethylene sheeting (drop sheet) shall be placed on the ground surfaces below the work area, including existing landscaping and shrubbery if working outside. The drop sheet shall extend a minimum distance of at least 10 feet in all directions from the working surfaces. Anchor any scaffolding or ladders to the ground below the plastic by cutting the plastic, using boards or other methods to avoid slippage. Weight plastic sheeting down and secure to the building or nearby walls with tape or other anchoring system. The edges of the plastic should be raised to prevent run-off and contain surface water. Extreme care shall be taken to ensure that paint chips, dust and water are not allowed to migrate beyond the plastic containment. Increase the size of the plastic sheeting to allow for larger containment area depending upon the height of the working surface and the potential for paint chips, dust and debris to fall outside the containment area.
5. For exterior surfaces, all nearby area drains, storm drains or other waterways in close proximity should be bermed or covered to prevent contaminated water, dust or other runoff from entering the storm drain system.

6. Ensure that all critical openings (doors, windows, vent openings, etc.) within close proximity (~20') of the designated work area are sealed to prevent migration of dust and debris and to prevent accidental exposure to unprotected areas near the work surfaces. All plastic sheeting should be a minimum 6-mil thickness.
7. Remove all moveable items to at least 20' distance from the working surfaces. Items that cannot be moved should be protected in place by covering with plastic.
8. Erect temporary exclusion zones in the designated work areas by using caution tape, fencing or similar barriers at a distance of at least 20' from the perimeter of the building. Require local pedestrian and vehicle traffic to use alternate routes of ingress and egress if sidewalks, parking areas or other traffic patterns are within the 20' buffer.
9. Post warning signs at the entrance to each work area and, if working outdoors, at a 20' perimeter, unless distance to nearest building or sidewalk is less than 20'.
10. Pre-clean surfaces in the proposed work areas by HEPA vacuuming, wet sweeping, mopping or raking up all visible paint chips and suspected lead-paint debris. This should be performed prior to placement of plastic sheeting. If landscaped areas are located in the immediate work area, we recommend collecting soil samples to determine the background levels of total lead prior to beginning mitigation work. These samples may be used later if post-mitigation sampling shows elevated lead levels in surface soils.
11. All workers shall wear appropriate personal protective equipment, including full-body disposable coveralls, half-mask or full-face air purifying respirators with HEPA filtration cartridges, gloves and similar controls per the Contractor's Health & Safety Program for lead abatement work.
12. A worker decontamination area shall be placed within a designated location at the work site. The decontamination area shall accommodate preparation of all personnel entering and exiting the work site. At no time will changing into or out of protective clothing be permitted outside of the decontamination area. All personal protective equipment (respirators, suits, gloves, etc.) shall be decontaminated or disposed of prior to leaving the site. Washing facilities must be provided within the designated decontamination area to allow workers to wash their face and hands each time they leave the work area.
13. Exterior work shall not be conducted in conditions where external wind speed exceeds 20 mph.
14. Contractor shall not remove paint by burning, torching, power sanding or dry scraping without HEPA attachments, or any uncontained abrasive blasting. Chemical strippers containing methylene chloride shall not be used. The use of rotary tools, power tools and other mechanical removal methods that would generate lead dust is prohibited unless they can be operated using vacuum attachments equipped with HEPA filtration equipment and using full containment with negative air conditions.

15. Hydroblasting, pressure washing or other abrasive blasting is prohibited unless full containment can be achieved using appropriate controls to capture all effluent and dust emissions. All wastewater must be contained and filtered to remove lead paint chips or disposed at a permitted off-site facility.
16. Any alternative method must be pre-approved by the Environmental Consultant prior to implementation.
17. All surfaces shall be scraped to remove loose and flaking materials, using wet methods. Following all scraping of paint to an intact condition, the surfaces shall be wet wiped with a surfactant/water mixture to remove surface dust and debris. The surfaces shall be thoroughly dried prior to application of primer or encapsulating materials.
18. Contractor shall use wet methods, HEPA filtration equipment or similar controls to prevent dust and fiber emissions from impacting the structure. Contractor shall take appropriate measures to prevent lead dust which is generated from escaping the immediate work area, including the installation of critical barriers on the interior of the building as necessary to prevent migration of lead dust.
19. All visible debris shall be cleaned up at the end of each workday. Prior to removal, all protective polyethylene sheeting will be HEPA vacuumed and wet wiped and disposed of in accordance with this work plan.
20. Containerized lead waste from paint scraping activities, ceramic tile removal or similar waste generating activities shall be segregated and disposed of in accordance with the waste disposal section below.
21. All surfaces within the work area shall be inspected to ensure the site is free of paint chips and related debris upon conclusion of all field work to remove or mitigate lead paint, removal of lead components, removal of ceramic tiles, or similar activities. Confirmation dust wipe samples are recommended to ensure that the site has not been contaminated by the lead mitigation work.
22. Upon conclusion of the lead mitigation in a work area, FCG Environmental shall conduct a clearance examination and provide appropriate documentation of compliance with lead regulations. Wipe samples may be collected from exterior surfaces as necessary to document proper clearance. Clearance levels per EPA and California are as follows:

<u>Location</u>	<u>State & EPA Clearance Levels</u>
Interior Floors	40 µg/ft ²
Interior Window Sills	250 µg/ft ²
Exterior Surfaces	400 µg/ft ²

23. For exterior work, soil samples shall be taken in accordance with HUD Guidelines using composite sampling with a minimum of 5 aliquots per each area sampled. We recommend collect baseline soil samples prior to project commencement to determine lead concentrations in soils. Additional samples should be taken upon completion of field work to determine if additional lead

FCG Environmental

Lead Safe Work Practices

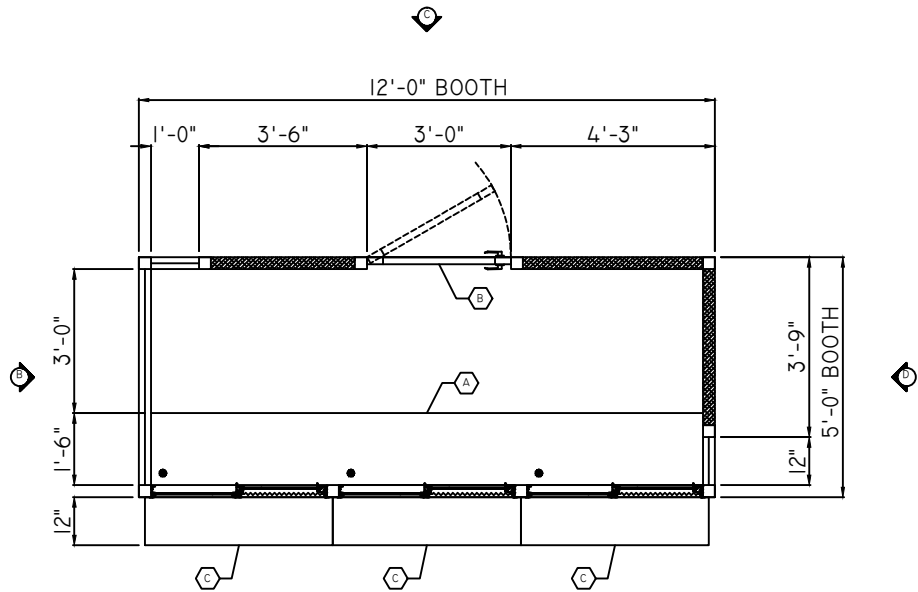
contamination has resulted from paint preparation. Please contact FCG for additional information or assistance regarding soil sampling protocols and requirements.

24. Soil samples will be analyzed for Total Lead by EPA Method 7420 or equivalent. Concentrations above 1,000 mg/kg meet California Hazardous Waste criteria and will require treatment or excavation to remove the impacted soils per state regulations. Concentrations greater than 50 mg/kg shall be analyzed by Waste Extraction Test (WET) method to determine soluble lead levels. Concentrations of soluble lead in soils above 5 milligrams per liter (mg/L) meet California Hazardous Waste criteria and must be treated or excavated per state regulations.
25. If soil contamination is found, abatement or mitigation work may be required, including excavation of top soils, importing clean fill or sod, paving, planting of thorny bushes or similar exclusion measures to prevent contact with contaminated soils. Further discussion with the client should be conducted prior to implementation of mitigation measures.
26. The prepared surfaces shall be coated with a suitable primer or encapsulating compound as soon as practical following lead mitigation tasks. The priming or encapsulation may be conducted by licensed painting contractors or others and is not required as part of the mitigation contractor's scope. All primers, encapsulating materials or other coatings must be compatible with the underlying substrate and the specified finish coating per paint specification.
27. Once the painted components such as doors, windows, frames, etc., have been stabilized, they may be removed by normal contracting personnel as long as no lead dust will be generated during the removal process. If sanding, grinding, cutting or similar activities will be required that will disturb lead-based paint, then lead trained workers must perform these tasks using appropriate control measures.
28. If components with lead-based paint will be stripped using a chemical dip tank or similar methods, the resulting waste is considered hazardous and must be disposed of according to Title 22 of the California Code of Regulations and EPA (40 CFR) regulations. Permits may be required for on-site treatment. Further investigation into use of a dip-tank or chemical stripping may be required to determine all handling, permitting and disposal requirements. If components are sent to an off-site location, the outside vendor must be notified that lead-based paint is present in the various components and will require proper handling and disposal.

Lead Waste Disposal

1. The Contractor is responsible for any required testing and for the ultimate disposal of all waste generated from the work of this section. This waste may include, but is not limited to, lead-painted building components, lead paint chips, asbestos window putty, solvents and caustics used in any stripping process, HEPA filters, wash water, disposable work clothes and respirator filters.

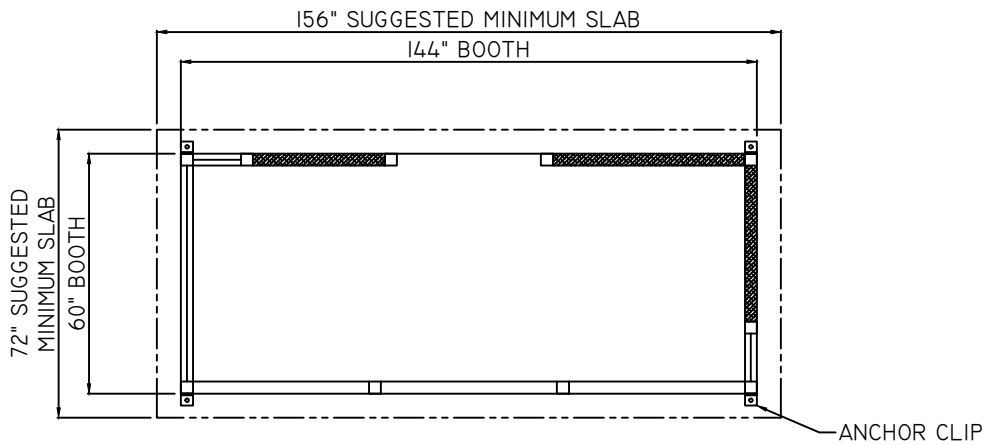
2. The Contractor shall assume that all lead paint chips, sludge from lead removal stripping, or similar lead-containing waste is hazardous waste unless laboratory analytical data proves otherwise. Contractor shall submit laboratory analysis characterizing all lead containing waste for disposal.
3. Waste samples will be analyzed for Total Lead. Concentrations above 1,000 mg/kg meet California Hazardous Waste criteria and will require disposal at a permitted Class I Landfill or treatment facility. Concentrations of Total Lead greater than 50 mg/kg shall be analyzed by Waste Extraction Test (WET) method to determine soluble lead levels by STLC. Concentrations above 5 milligrams per liter (mg/L) meet California Hazardous Waste criteria and must be disposed as hazardous waste. If necessary, analysis by TCLP method will be required to determine if the concentration is below 5 mg/L for determination of RCRA waste criteria. Lead containing waste streams not meeting hazardous waste criteria per federal or state requirements may be disposed at a permitted facility with proper approvals. FCG can assist as necessary in the proper characterization of waste streams.
4. Contractor shall store all waste in appropriate, compatible containers/drums for disposal as hazardous waste and shall be labeled and stored in accordance with all applicable regulations. Containerized lead waste from exterior scraping activities (paint chips, soils, etc.), chemical stripping of lead painted building components shall be segregated and disposed of in accordance with current regulations per Title 22 of the California Code of Regulations.
5. Copies of all waste disposal documentation shall be delivered to the owner or Environmental Consultant upon receipt. The Contractor shall notify and obtain approval at permitted disposal or treatment facilities, with a copy to the Owner, for disposal of all lead or asbestos waste streams.
6. The Contractor is responsible for completing all disposal documents, which may include, but are not limited to, waste profiles, hazardous waste manifests and land ban restriction forms. The property owner shall be designated as the Generator on all manifesting documents. All hazardous waste manifests shall be signed by a designated owner's representative who will also provide the appropriate EPA # and Generator Status. All disposal documents shall be delivered to the owner's representative for signature prior to waste transportation.



PLAN VIEW

EQUIPMENT

- A. COUNTER WITH 2" GROMMET HOLES, LOCATED 32" ABOVE FLOOR.
B. SWING ENTRY DOOR, FULLY WEATHER-STRIPPED WITH LEVER HANDLE LOCKSET, GEARED ALUMINUM CONTINUOUS HINGE, AND HYDRAULIC CLOSER.
C. STAINLESS STEEL EXTERIOR SHELF 12" X 47" MOUNTED TO BUILDING WITH TOP LOCATED 36" ABOVE GRADE.

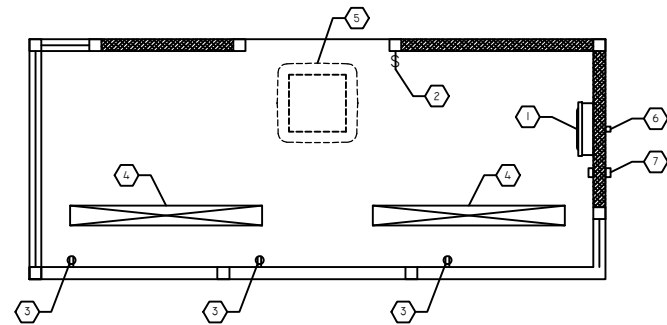


FOOT PRINT

THIS UNIT MUST BE ANCHORED TO CONCRETE SLAB/FOUNDATION

FAILURE TO SECURELY ANCHOR BOOTH MAY RESULT IN OVERTURNING OF UNIT AND SERIOUS INJURY OR DEATH TO OCCUPANT OR TO OTHERS.

DESIGN OF SLAB/FOUNDATION BY OTHERS. CONSULT A PROFESSIONAL ENGINEER FAMILIAR WITH APPLICABLE LOADS AND SITE CONDITIONS FOR THE LOCATION.



ELECTRICAL PLAN

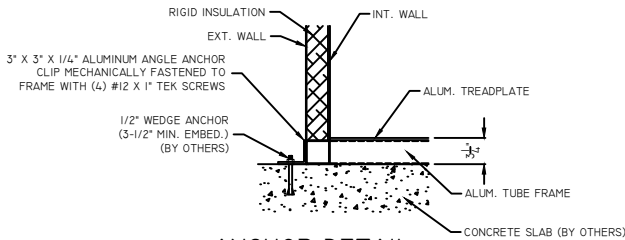
ELECTRICAL NOTES

- 120/240 VOLT, SINGLE PHASE, 8-CIRCUIT LOAD CENTER PANEL (NO MAIN BREAKER PROVIDED).
- LIGHT SWITCH.
- 120 VOLT, DUPLEX RECEPTACLE.
- FLUORESCENT LIGHT FIXTURE, WITH T-8, 32 WATT LAMP(S).
- 120 VOLT, 13,500 BTU COOL ROOF TOP AIR CONDITIONING UNIT.
- 1" CONDUIT NIPPLE THROUGH WALL TO LOAD CENTER INTERIOR FOR INCOMING POWER FEED SUPPLY.
- 2" CONDUIT NIPPLE THROUGH WALL FOR FUTURE LOW VOLTAGE USE.

FACTORY INSTALLED COMPONENTS NOTES:

- ALL ELECTRICAL COMPONENTS TO BE LISTED BY A (NRTL) NATIONALLY RECOGNIZED TESTING LABORATORY.
- ALL WIRING PER N.E.C. STANDARD.
- ALL WIRING TO BE #12 MINIMUM THHN ENCLOSED IN METALLIC RACEWAY.
- ALL BRANCH CIRCUITS HAVE GREEN GROUND CONDUCTOR.

LOCATION OF DEVICE MAY VARY DUE TO MEETING CODE REQUIREMENTS AND PLACEMENT WITHIN THE STRUCTURE



ANCHOR DETAIL

ANCHORS LOCATED PER PROJECT DRAWINGS.
MINIMUM OF FOUR (4) ANCHORS REQUIRED
PER BOOTH (TWO PER END).

CONCRETE FOUNDATION/SLAB BY OTHERS

DESIGN IS BASED ON A MINIMUM 6" DEEP, 3,000 PSI MINIMUM (28 DAY ACI 318) REINFORCED. THE FOUNDATION/SLAB SHOULD BE A MINIMUM OF 12" WIDER THAN THE BUILDING FOOT PRINT DIMENSIONS. THIS IS TO PROVIDE A 6" CONCRETE BORDER ON EACH SIDE OF THE BUILDING.

THIS DETAIL IS FOR REFERENCE PURPOSES ONLY. THE BUILDING(S) MUST BE SECURELY ANCHORED IN PLACE AND MUST BE PROPERLY GROUNDED.

ADEQUATE SIZED ANCHOR BOLTS SHALL BE USED. THE SIZE AND DEPTH OF THE ANCHORS SHOULD BE OF SUFFICIENT DESIGN TO WITHSTAND THE APPLICABLE WIND SPEED AND SEISMIC LOADS FOR THE LOCATION OF INSTALLATION AND SOIL CONDITIONS.

PLEASE CONSULT A PROFESSIONAL ENGINEER FAMILIAR WITH THESE PARAMETERS FOR THE LOCATION.

FINISH SCHEDULE	
ITEM	DESCRIPTION
FLOOR	ALUMINUM TREADPLATE
CANOPY	WHITE
WALLS	WHITE
CEILING	WHITE
COUNTER	WHITE PLASTIC LAMINATE
SAFETY GLAZING	CLEAR TEMPERED

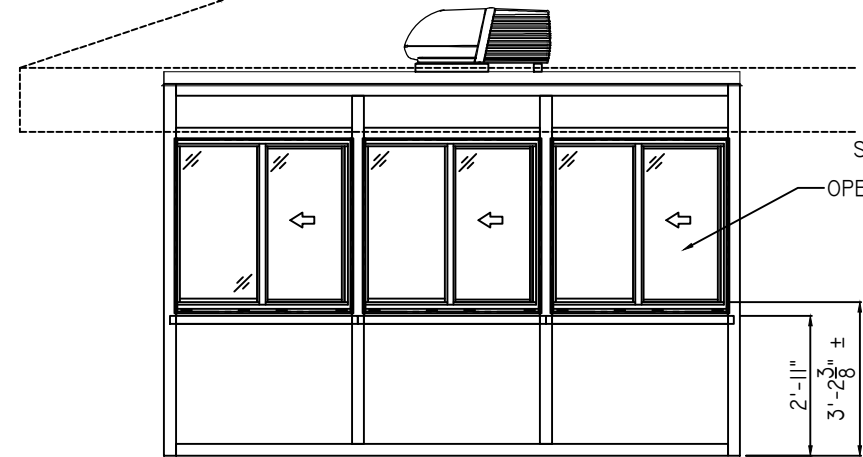
PI8-011_LMA

MODEL NUMBER MFI-50120-TIC		APPROVED BY:	
DATE: 3-26-2018	DRAWING NUMBER PI8-011	DRAWN BY: DNE	REVISION: 4-2-2018
SCALE: 1/4" = 1'-0"			
LMA ARCHITECTS SANTA BARBARA METROPOLITAN TRANSIT DISTRICT SANTA BARBARA, CA			
MFI Mardan Fabrication, Inc. 41249 Irwin Drive, Harrison Twp. MI 48045 Phone: 800-882-5820			DRAWING SHEET SD-I

NOTE: THIS DRAWING AND DESIGN ARE THE PROPERTY OF MARDAN FABRICATION, INC. (MFI). IT MUST NOT BE REPRODUCED IN ANY MANNER, NOR SHALL IT BE SUBMITTED TO OUTSIDE PARTIES FOR EXAMINATION WITHOUT OUR CONSENT. IT SHALL BE USED ONLY AS A MEANS OF REFERENCE TO WORK DESIGNED AND FURNISHED BY MARDAN. MARDAN RESERVES THE RIGHT TO MAKE CHANGES TO DESIGN FOR ENGINEERING PURPOSES WITHOUT NOTICE. REVISIONS MAY NOT BE NOTED.

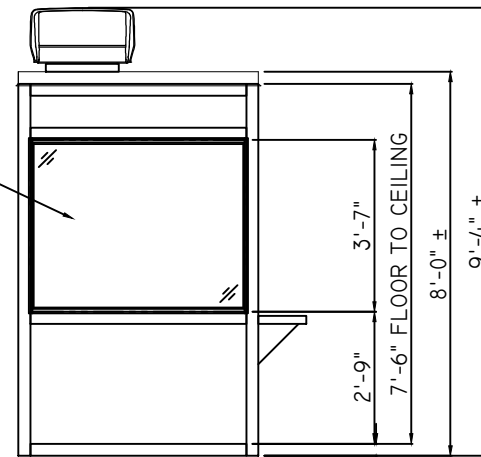
PROJECT MANUAL - APPENDIX B
SANTA BARBARA MTD
TERMINAL 2 RECOMMISSIONING PROJECT

SITE PROVIDED AND
INSTALLED CANOPY



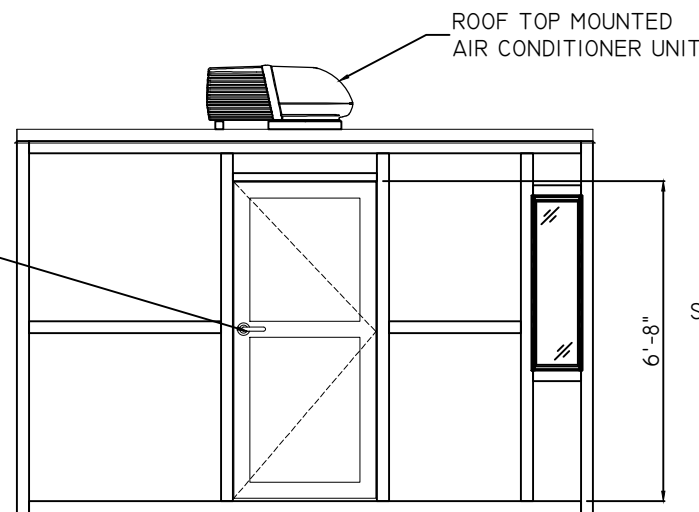
ELEVATION "A"

SAFETY GLASS TYPICAL
OPERABLE WINDOW



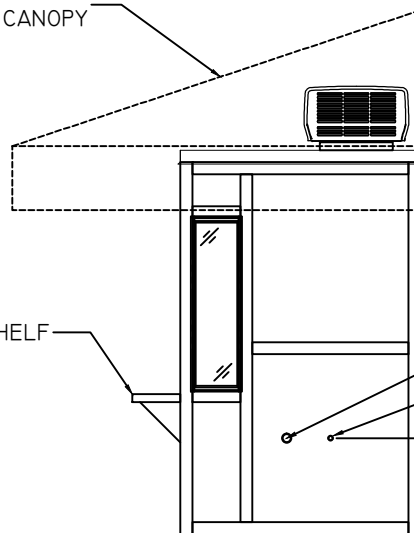
ELEVATION "B"

SWING ENTRY DOOR



ELEVATION "C"

SITE PROVIDED AND
INSTALLED CANOPY




ELEVATION "D"

STAINLESS STEEL SHELF

LOW VOLTAGE NIPPLE
POWER SUPPLY NIPPLE

NOTE: THIS DRAWING AND DESIGN ARE THE PROPERTY OF MARDAN FABRICATION, INC. (MFI). IT MUST NOT BE REPRODUCED IN ANY MANNER, NOR SHALL IT BE SUBMITTED TO OUTSIDE PARTIES FOR EXAMINATION WITHOUT OUR CONSENT. IT SHALL BE USED ONLY AS A MEANS OF REFERENCE TO WORK DESIGNED AND FURNISHED BY MARDAN. MARDAN RESERVES THE RIGHT TO MAKE CHANGES TO DESIGN FOR ENGINEERING PURPOSES WITHOUT NOTICE. REVISIONS MAY NOT BE NOTED.

MODEL NUMBER MFI-50120-TIC		APPROVED BY:	
DATE: 3-26-2018	DRAWING NUMBER PI8-011	DRAWN BY: DNE	
SCALE: 1/4" = 1'-0"		REVISION: 4-2-2018	
LMA ARCHITECTS SANTA BARBARA METROPOLITAN TRANSIT DISTRICT SANTA BARBARA, CA			
 <div>Mardan Fabrication, Inc. 41249 Irwin Drive, Harrison Twp. MI 48045 Phone: 800-882-5820</div>		DRAWING SHEET SD-2	



Mardan Fabrication

41249 Irwin Drive
Harrison Township, MI 48045
800-882-5820
FAX: 855-313-4159
www.mardanfab.com

STANDARD BOOTH INSTALLATION INSTRUCTIONS

CONCRETE SLAB: The concrete slab must be flat and level. The generic size for the concrete slab is 6" thick, with the dimensions being 6" larger than the booth perimeter. No anchor imbeds are required. A local engineer should design the slab, and will be required to obtain a permit (if permit is required).

ELECTRICAL: The electrical rough-ins for the concrete slab must be coordinated to fit into the electrical access cut-out in the booth floor. The standard electrical panel for the booth is 120/240V, 60Hz, Single Phase, 3-wire, with space for eight single-pole breakers. Branch circuit breakers are typically provided with the booth for factory provided equipment. (Your electrical load center panel may differ - verify per price quotation, purchase order and drawings.) The electrical component with the most amp draw is a roof-mounted air conditioner, which has a maximum amperage of 18. It is important to consider any other peripheral electrical components added to the booth after installation which may increase the service amp requirements.

OFF-LOADING: Once the booth arrives on-site, a forklift will be required to off-load it and set it in place. There will be a cut-out in the floor of the booth for electrical access. The booth must be raised high enough to fit over the rough-ins in the concrete slab. To make the installation easier, cut down the stub-ups to a minimal height. Set the booth in place with a wood block under each corner so that the forks of the forklift can be removed from under the booth.

SETTING: Have someone remove the blocks from under the booth while elevating each side of the booth with a pry bar. Check the booth to ensure it is sitting level, plumb and square. Shim as required until it is slightly sloped toward the roof drain or scupper.

IMPORTANT!

Doors and operating windows are set and checked for fit and operation at the factory. However, during loading, off-loading and installation, it is possible that some twisting of the booth may occur causing the doors to bind. Some shimming may be required at various points under the booth until the doors operate freely. Excessive shimming or slope to the booth may adversely affect the way the door(s) and/or windows operate. Locking mechanisms may also vibrate loose during transport. Check for proper function and adjust or tighten as necessary.

ANCHORAGE: After the booth is set, drill a hole into the concrete at each anchor clip and fasten the booth to the concrete with 1/2" wedge anchors at each anchor point. Anchors must be embedded in concrete a minimum of 3-1/2". In climates where frost is common grout or a sealant must be applied in the hole around the anchor to prevent ice damage of the concrete.

For booths with interior anchor points, there are pre-drilled access holes under the finished flooring. Replace the floor covering (or enclosure cap) after anchoring.

If there are any gaps between the booth frame and concrete, fill with a butyl-type sealant. If the gap is too large to fill with sealant, fill with grout.

The unit is now ready for final electrical connection by a licensed electrician.



BUILDING OPERATIONS & MAINTENANCE MANUAL

TABLE OF CONTENTS

Table of Contents	2
Introduction	3
Operable Equipment	4
Sliding Windows	4
Sliding Doors	4
Swing Doors	4
Weather Strip	4
Light Fixtures	4
Heaters	4
Air Conditioning	4
Rest Room Fixtures	4
Care and Cleaning of Painted Surfaces	5
Care and Cleaning of Glazing	6
Care and Maintenance of Ceiling/Roof Panels	7
Maintenance of Roof Coating	7
Care and Cleaning of Plastic Laminate Counter	8
Care and Cleaning of Stainless Steel Surfaces	9
Care and Cleaning of PVC Flexi-Tile Flooring	9
Optional Equipment Warranty Information	10
Replacement Parts	10

Introduction

The Mardan fabricated building is a factory built structure that is designed for commercial use. It is fabricated with quality elements as should last for many years of use.

Purpose of this manual

The purpose of this manual is to aid you in operating and maintain the building. Over time and use this building will require cleaning, adjusting and servicing. Please consult this manual for assistance in doing so.

If you have a question on items that are not contained in this manual please contact the factory for assistance.

Factory Toll Free Number: 800-882-5820

E-mail: info@mardanfab.com

When contacting the factory please have the units Serial Number. The serial number can be found on the name plate attached to the building.



Example of the Name Plate

Note: Instructions contained in this manual contain user information on optional equipment and may not apply to your building application.

Operable Equipment

Note: Furnished equipment may vary for each unit and may not apply to your building.

Sliding Windows:

Tracks in sliding windows should be cleaned at regular intervals and drain holes must be kept open.

Sliding Doors:

Sliding door tracks and carriage trolleys should be cleaned at regular intervals to prevent accumulation of dirt that might interfere with the door and cause premature wear of the trolley wheels. Do **NOT** use graphite spray to lubricate the door's overhead carriage wheels as it is a granular lubricant that will break down the movable parts. Instead, use Nylube <http://nylube.com/Lubes.html>

Make certain booth is level

Swing Doors:

Door hinges and Hydraulic Closer should be cleaned at regular intervals to prevent accumulation of dirt which might interfere with the door and cause premature wear of the door hardware. Make certain booth is level. Check and tighten hinge screws if necessary

Weather Stripping:

Door and window weather stripping should be checked at regular intervals for adjustment or damage.

Missing or damaged pieces should be replaced to seal unit against adverse weather conditions.

Light Fixtures:

Light fixtures equipped with acrylic lens should be cleaned regular interval to insure maximum light output.

Light fixtures containing two or more lamps should be replaced as a set.

Fan Forced Heater:

Refer to Heater Manufacturers instruction.

Periodically vacuum dirt and lint as required for safe and efficient operation.

Avoid using heater cabinets as a foot rest.

Do not put objects on or close to the heater, especially during operation.

Air Conditioner / HVAC Unit:

Refer to Heater Manufacturers instruction.

Periodically vacuum dirt and lint from grilles and clean filters as required for efficient operation.

Rest Room Fixtures:

Porcelain rest room fixtures may be cleaned with any over the counter rest room cleaner.

Appearance

Care and Cleaning of Painted Surfaces

Dirt and Other Surface Contaminants

As with any outdoor article, occasional cleaning may be necessary and desirable. A simple solution of detergent in warm water is the best way to maintain the like-new appearance. Detergents like Tide with less than 0.5% phosphate can be mixed at one cup per five gallons of water. Clean the affected areas with a sponge, soft cloth, mop or soft bristle brush, rinsing immediately. Although the paint will resist most mild cleaners and fresh water, take care not to scratch the painted surfaces. Make sure the surface is wet before you begin cleaning.

Chalking

All paints exposed to direct sunlight will slowly degrade over time, losing gloss and leaving a powdery chalk residue if not properly maintained. Rain and weather conditions will typically clean up the loose particles, but if build up persists, chalk can be removed using the same methods and materials described above. Be sure to rinse well and protect concrete and other surfaces.

Mold & Mildew

In warm and humid conditions, mold and mildew can grow on the pre-paint. If left for an extended period, the spores will penetrate the surface coating, causing staining and reducing the product's life. Mold and mildew should be cleaned thoroughly as soon as it is discovered. Mix one cup of mild soap (like Ivory) and one gallon of bleach into five gallons of water. Wash the surface with a sponge, soft cloth or soft bristle brush, for stubborn stains. Rinse thoroughly with fresh water. Take care to protect your eyes, skin and surrounding areas, including carpets, plants and clothes.

Grease, Oil, Wax, Etc.

Cleaning with detergent and water as described above should be tried first. Small areas can be cleaned with commercial kitchen cleaners, while larger areas may require a commercial grease remover diluted with some fresh water. For persistent stains, a less desirable alternative is to wipe with a solvent like a light Naphtha blend. Be sure to use plenty of clean cloths to avoid just moving the oily stain around and observe all personal safety and fire warnings of the product. Note: solvent wiping can affect the long term durability of the painted metal by softening or removing the film.

Things to Avoid

Cleaning with Acid based cleaners, like CLR, or high phosphate detergents, wire brushes, abrasive cleansers, sandpaper etc., should be avoided as these items will damage the painted surface.

Longevity of the exterior painted surfaces

The following should be done annually:

While washing unit, inspect for areas of chipping and scratches. Touch up areas with paint as they appear. Contact factory for identification of original paint coating. A good quality wax application will maintain the exterior finish appearance.

Care and Cleaning of Glazing

Glass

To clean the surface of glass, use a cloth with any commercial glass cleaner following the glass cleaner instruction for use.

Do not use razor blades or other sharp instruments, to remove spots.

Do not clean glass while exposed to direct sunlight.

Polycarbonate

DO NOT USE GLASS CLEANER ON POLYCARBONATE OR ACRYLIC GLAZING

To clean the surface of polycarbonate/acrylic glazing,

Wash polycarbonate sheet with a mild soap or detergent (such as 409 cleaner) and lukewarm water, using a clean sponge or a soft cloth. Rinse well with clean water. Dry thoroughly with a chamois or moist cellulose sponge to prevent water spots. Do not scrub or use brushes or abrasives on these products; the UV coating is not mar resistant. Also do not use butyl cellosolve in direct sunlight.

Fresh paint splashes, grease and smeared glazing compounds can be removed easily before drying by rubbing lightly with a good grade of naphtha or isopropyl alcohol. Follow the alcohol rub with a mild detergent wash with warm water and end with a thorough rinsing with clean water.

To Minimize Hairline Scratches

Scratches and minor abrasions can be minimized by using a mild automobile polish. Three such products that tend to polish and fill scratches are Johnson Paste Wax, Novus Plastic Polish #1 and #2, Novus, Inc., Minneapolis, MN and Mirror Glaze plastic polish (MG M10) Mirror Bright Polish Co., Pasadena, CA. It is suggested that a test be made on a sample of the polycarbonate sheet with the product selected and that the polish manufacturer's instructions be followed.

Very Important.

DON'T use abrasive or highly alkaline cleaners on the polycarbonate.

DON'T scrape the polycarbonate sheet with squeegees, razor blades or other sharp instruments.

DON'T ever use benzene, gasoline, acetone or carbon tetrachloride on the polycarbonate sheets.

DON'T clean polycarbonate sheets in hot sun or on very hot days.

Products such as abrasive or highly alkaline cleaners, acetone, carbon tetrachloride, benzene or leaded gasoline should not be used, and the sheet should not be cleaned in hot sun or at high temperatures.

Some other compatible cleaners for polycarbonate plastic are:

Formula 409™, Top Job™, Joy™, Windex™ w/Ammonia, or Palmolive Liquid™

Be sure to read and follow the recommended care and cleaning procedures of cleaning products used.

Cleaning and Maintenance of Ceiling/Roof Panels

Dirt and Other Surface Contaminants

As with any outdoor article, occasional cleaning may be necessary and desirable. A simple solution of detergent in warm water is the best way to maintain the like-new appearance. Detergents like Tide with less than 0.5% phosphate can be mixed at one cup per five gallons of water. Clean the affected areas with a sponge, soft cloth, mop or soft bristle brush, rinsing immediately. Although the pre-paint will resist most mild cleaners and fresh water, take care not to scratch the painted surfaces. Make sure the roof is wet before you begin cleaning.

Chalking

All paints exposed to direct sunlight will slowly degrade over time, losing gloss and leaving a powdery chalk residue if not properly maintained. Rain and weather conditions will typically clean up the loose particles, but if build up persists, chalk can be removed using the same methods and materials described above. Be sure to rinse well and protect concrete and other surfaces.

Mold & Mildew

In warm and humid conditions, mold and mildew can grow on the pre-paint. If left for an extended period, the spores will penetrate the surface coating, causing staining and reducing the product's life. Mold and mildew should be cleaned thoroughly as soon as it is discovered. Mix one cup of mild soap (like Ivory) and one gallon of bleach into five gallons of water. Wash the surface with a sponge, soft cloth or soft bristle brush, for stubborn stains. Rinse thoroughly with fresh water. Any bleach left on the facing will attack the surface coating and the sealants used to seal the roof. Take care to protect your eyes, skin and surrounding areas, including carpets, plants and clothes.

Grease, Oil, Wax, Etc.

Cleaning with detergent and water as described above should be tried first. Small areas can be cleaned with commercial kitchen cleaners, while larger areas may require a commercial grease remover diluted with some fresh water. For persistent stains, a less desirable alternative is to wipe with a solvent like a light Naphtha blend. Be sure to use plenty of clean cloths to avoid just moving the oily stain around and observe all personal safety and fire warnings of the product. Note: solvent wiping can affect the long term durability of the pre-painted metal by softening or removing the film.

Things to Avoid

Cleaning with Acid based cleaners, like CLR, or high phosphate detergents, wire brushes, abrasive cleansers, sandpaper etc., should be avoided as these items will damage the pre-painted surface.

Maintenance of Roof Top Coating and Seams

It is recommended that the coating installation be checked on a regular schedule with additional inspections after the system has been exposed to severe weather conditions. Failure to do so can cause leaks, damage and may affect the factory warranty. Recoating or small area touch up can be made at any time by following recommended application procedures. Please consult the Mardan factory on how and where to purchase recommended roof coating products.

Care and Cleaning of Plastic Laminate Counter

Everyday cleaning of our products is as simple as a quick wipe with a damp sponge. All resist muddy fingerprints, coffee spills and so much more.

Be sure to read and follow the recommended care and cleaning procedures of cleaning products used.

Routine Care

To clean the surface, use a damp cloth or sponge and a mild soap or detergent. Rinse thoroughly with warm water and wipe dry.

Difficult stains such as coffee or tea can be removed using a mild household cleaner/detergent and a soft bristled brush, repeating as necessary.

If a stain persists, use a paste of baking soda and water and apply with a soft bristled brush. Light scrubbing for 10 to 20 strokes should remove most stains. Although baking soda is a low abrasive, excessive scrubbing or exerting too much force could damage the decorative surface, especially if it has a gloss finish.

Stubborn stains that resist any of the above cleaning methods may require the use of undiluted household bleach or nail polish remover. Apply the bleach or nail polish remover to the stain and let stand no longer than two minutes. Rinse thoroughly with warm water and wipe dry. This step may be repeated if the stain appears to be going away and the color of the laminate has not been affected.

WARNING: Prolonged exposure of the laminate surface to bleach will cause discoloration.

Caution

- Acidic or abrasive cleaners can damage laminate surfaces; do not use them.
- Drain cleaners containing lye will permanently damage any laminate surface. If you spill a drain cleaner, wipe it up immediately and rinse several times with water.
- Hair, textile and food dyes can cause permanent stains. If dye should happen to spill, wipe it up immediately with dishwashing detergent or an all-purpose cleaner.
- Never place pots or dishes directly from the oven or burner on an unprotected laminate surface; such extreme heat can cause cracking or blistering.
- Do not work with oven cleaners on an unprotected countertop. Wipe spills away promptly and rinse several times with water.
- Rust removers contain harsh chemicals which will quickly cause permanent damage. If a spill occurs, wipe off all residue immediately, wash thoroughly with soapy water and rinse several times.
- Steel wool and other abrasive pads will damage laminate. Don't use them for cleaning and don't store steel wool pads on your countertop; the metal can rust and leave stains.
- Toilet bowl cleaners contain harsh chemicals that can cause permanent damage. If spills occur, wipe up immediately, wash surface with soapy water and rinse several times.

Care and Cleaning of Optional Stainless Steel Surfaces

Stainless steel is a rust resistant, corrosion resistant, low-carbon steel. However, it is not impervious to contamination. Stainless steel must be kept clean and free of contaminants.

Be sure to read and follow the recommended care and cleaning procedures of cleaning products used.

Routine Care

To clean the surface, use a damp cloth or sponge and a mild soap. Rinse thoroughly with warm water and wipe dry.

Caution

- DO NOT use products containing chloride. Such as bleach or products containing bleach.
- DO NOT use products containing muriatic acid/hydrochloric acid.
- DO NOT use products containing iron or water with high iron content.

Corrosion or discoloration

Corrosion or discoloration should be removed as soon as possible.

Most discoloration can be removed with a mild cleanser such as Ajax® or a commercial stainless steel cleaner and a Scotchbrite® pad.

For rusty stains on satin finished stainless steel most can be removed using naval jelly. Product manufacturer's directions must be followed.

For rusty stains on brushed finished stainless steel most can be removed using mild abrasive products such as Bon Ami or Bar Keepers Friend. Product manufacturer's directions must be followed.

Permanent damage and pitting can occur on stainless steel surfaces if not cleaned regularly.

Care and Cleaning of Optional PVC Interlocking Flexi-Tile Flooring

PVC tile floors generally only require warm water when cleaning. We do not recommend a detergent on the PVC floors because it leaves a sticky residue and does not rinse clean, making it more difficult to clean. Use a 50/50 water and vinegar solution which is residue free. If you find you PVC floor requires a deeper cleaning, you can try Ivory dish liquid. Rinsing will be easier and leaves no sticky build up.

DO NOT USE BLEACH on the PVC tile as it will discolor the tile.

Optional Equipment Warranty Information

This is a partial list of optional equipment warranty information. Please see separate information shipped with your building for other warranty contact information.

General Electric Warranty Info:

For Warranty service, GE thru wall air conditioners (Room air conditioner/HVAC unit or Zoneline unit) can be obtained by calling **1-800-GE-CARES**.

You can also self-schedule service on any appliance by visiting the GE

Online Service Scheduler, http://www.geappliances.com/service_and_support/service/

To schedule an appointment, you must have the person to contact, the address of the location, a description of the problem, and directions. If possible, a second person point of contact.

You should have the model number of the unit, and for our records, the serial number of the booth.

Warranty Service on RVP roof top RV style a/c units:

Contact RV Products @ 574-294-6561. He will need your name and phone number, location of the unit, whom to contact about the problem, any description of the problem, the model number and serial number of the unit, and if possible what efforts have been made to determine what was wrong.

Replacement Parts:

Replacement part are readily available from Mardan Fabrication, Inc. When requesting replacement parts please provide the units Serial Number located on the Mardan (MFI) nameplate (see page 3 for image of nameplate).

To Order Parts Contact: Mardan Fabrication, Inc.
 (800) 882-5820
 info@mardanfab.com